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USAAVLABS TECHNICAL REPORT 68-1

FLIGHT LOADS INVESTIGATION OF COMBAT ARMED AND ARMORED CH-47A HELICOPTERS OPERATING IN SOUTHEAST ASIA

By

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March 1968

U. S. ARMY AVIATION MATERIEL LABORATORIES
FORT EUSTIS, VIRGINIA

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TECHNOLOGY INCORPORATED
DAYTON, OHIO

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Prepared by

Technology Incorporated
Dayton, Ohio

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FORT EUSTIS, VIRGINIA

ABSTRACT

From a structural flight loads program on three armed and armored CH-47A helicopters, 207 hours of valid multichannel flight data were recorded as the helicopters operated from air bases in Southeast Asia. Data were processed and analyzed according to four distinct flight phases, termed mission segments: (1) takeoff and ascent; (2) maneuver; (3) descent, flare, and landing; and (4) steady state. Data are presented in the form of time and occurrence tables, histograms, and exceedance curves. These data indicate the time spent in the mission segments and parameter ranges; the number of peak parameter values occurring in the ranges of the given parameter, during each of the mission segments, and in the ranges of one or more related parameters; and the time to reach or exceed given maneuver and gust normal load factors and lateral and longitudinal load factors. The largest normal load factor was 1.95, which occurred at a 100-knot airspeed and with a 28,027-pound gross weight. In contrast to previous studies of cargo and transport CH-47A's whose activity was mostly under steady-state conditions, the armed CH-47A's spent more than half of their time in the maneuver mission segment and had a much more pronounced loads spectrum.

FOREWORD

Technology Incorporated, Dayton, Ohio, prepared this report to cover its effort on a flight loads program to collect, process, and analyze 200 hours of valid flight data from three armed and armored CH-47A helicopters operating in Southeast Asia. This flight loads program was an integral part of a comprehensive CH-47A program which also included data collected from three unarmed CH-47A's. USAAVLABS Technical Report 68-2 presents the results of the data acquisition for the unarmed aircraft. The total program was sponsored by the U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, under Contract DA 44-177-AMC-363(T). The Army project monitor for all programs was Mr. William T. Alexander.

The prime Technology Incorporated personnel engaged in this program were as follows: Mr. Joseph F. Braun, project engineer, who directed the installation and operation of the data recording systems; Mr. John Nash, who directed the data digitizing; Mr. William Morrin, who wrote the computer programs for the data processing; and Messrs. Larry Clay and F. Joseph Giessler, who analyzed and compiled the data.

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LIST OF SYMBOLS

Symbol		Computer Equivalent
C_T	thrust coefficient	CT
C_T/σ	thrust coefficient ratio	CT/S
h_d	density altitude, feet	
n_z	normal load factor	NZ
n_x	longitudinal acceleration	NX
n_y	lateral acceleration	NY
OAT	outside air temperature, $^\circ$F	
P_a	atmospheric static pressure, inches of mercury	
R	rotor radius, 29.55 feet	
V	airspeed, feet per second or knots	
W	gross weight, pounds	
μ	rotor tip speed ratio	MU
π	ratio of circumference to diameter of circle	
ρ	local air density, lb-sec^2/ft^4	
σ	rotor solidity, 0.062 (Reference 1)	S
Ω	rotor angular velocity, radians per second	

INTRODUCTION

Under contract to the U.S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, Technology Incorporated conducted a multichannel flight loads program on the armed and armored CH-47A helicopter. To acquire the desired data, three helicopters assigned to the 1st Cavalry Division (Airmobile), 228th ASHB, 1st Aviation Detachment, were each instrumented with flight loads recording systems. The serial numbers of the instrumented aircraft were 64-13145, 64-13149, and 64-13154. All recordings were made between August 1966 and May 1967, while the helicopters operated in Southeast Asia. From 470 hours of recorded flight data, 207 hours of valid data were processed, analyzed, and detailed in graphical and tabular form for their presentation in this report.

With normal acceleration separated into maneuver- and gust-induced categories, most of the data presentation consists of time and occurrence tables. Most of the tables are broken down into ranges of a third variable or of a third and a fourth variable for cross-correlation purposes. Significant aspects of the time tables are presented as histograms; the occurrence data for normal accelerations are presented as exceedance curves.

HELICOPTER DESCRIPTION

The armed and armored CH-47A is a special-purpose helicopter whose payload capability is used to mount extensive armaments for aerial fire support and armor to protect the crew and the helicopter. Specifically, this helicopter has five gunnery stations, two on each side and one aft; each is equipped with either a 7.62-mm or a .50-caliber machine gun. Fixed pylons on either side support 20-mm guns and either 2.75-inch rocket pods or 7.62-mm minigun pods. Extensive armor protects the crew and vital aircraft components.

These helicopters have the mission of providing aerial fire support while escorting airmobile formations; of performing reconnaissance and security operations; and of supporting other offensive, defensive, and retrograde actions as a part of a highly mobile arms team. Deployment is generally as a team to ensure mutual support and to decrease vulnerability of the aircraft as well as to increase rapidity and ease of target acquisition.

DATA RECORDING AND PROCESSING

DATA RECORDING

An oscillograph recording system was installed in each of the three CH-47A helicopters. The functional block diagram in Figure 1 illustrates the operation and integration of the components comprising the recording system. Ten parameters were recorded on the oscillograms: (1) air-speed, (2) altitude, (3) normal acceleration, (4) lateral acceleration, (5) longitudinal acceleration, (6) longitudinal cyclic control stick position, (7) collective control stick position, (8) rotor rpm, (9) outside air temperature, and (10) time. Between August 1966 and May 1967, 470 hours of flight data were recorded. Of these 470 hours, 207 proved to be valid. The valid data represent 564 flights and 266 engine starts.

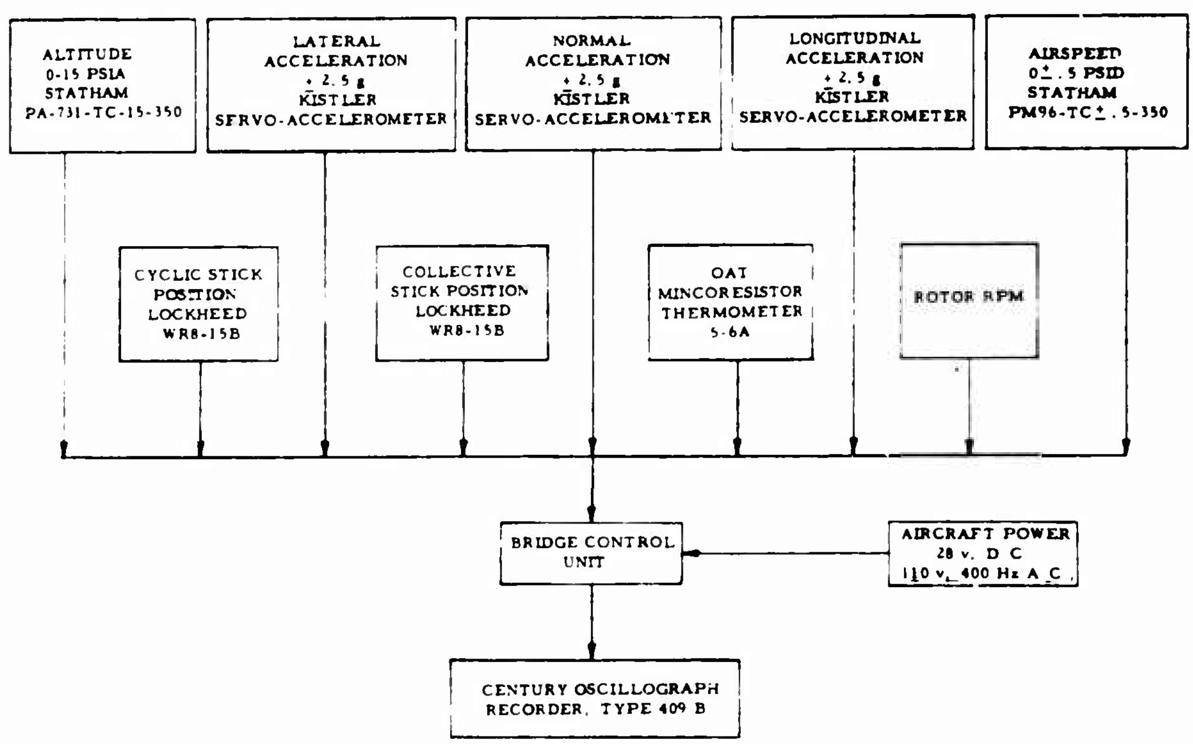

Figure 1. Block Diagram of CH-47A Instrumentation System

DATA EDITING

As the data processing editors first checked all oscillograms for evidence of any instrumentation malfunctioning, they removed all faulty records from processing and reported them to the Instrumentation Section. The editors then timed all acceptable records and identified the bounds for the following four mission segments in each flight: (1) takeoff and ascent; (2) maneuver; (3) descent, flare, and landing; and (4) steady state. During the first three mission segments, which comprised the transient parts of flight, the stick position traces showed no steady values from which they seemed to deviate, and the airspeed and altitude traces changed frequently. The criteria used to distinguish the mission segments in each flight were as follows: Mission Segment 1 (takeoff and ascent) included both the takeoff and the climb to the initial steady-flight altitude and the unsteady ascents to other steady-flight altitudes. Mission Segment 2 (maneuvering) consisted of those transient parts of flight whose characteristics differed from those of Mission Segments 1 and 3. During maneuvering, the normal acceleration trace was usually very active. In addition to the unsteady part of flare and landing, Mission Segment 3 (descent, flare, and landing) included the unsteady part of any descent, whether intended for a new steady-flight altitude or for landing. Mission Segment 4 (steady state) included those parts of the flight where the stick position traces were relatively steady and where the airspeed and altitude traces were steady or changing smoothly. Such characteristics prevailed during cruise, hover, and steady ascent and descent.

After demarcating the flights into mission segments, the editors marked the traces as follows to govern the data reading: The normal acceleration trace was marked wherever a peak met the following two conditions: (1) the peak fell outside prescribed threshold levels, and (2) the peak had a rise and fall (or fall and rise) that were each 50 percent of the peak value or 0.2g, whichever was greater. Whereas the prescribed thresholds were 0.8 and 1.2g, the editors used levels of 0.84 and 1.16g to ensure the inclusion of all valid peaks. However, any of the peaks read within the fixed threshold levels of 0.8 and 1.2g were eliminated during the computer processing. In addition, the editors identified each selected peak as being maneuver- or gust-induced. To determine whether a peak was induced by a maneuver or a gust, the editors noted the behavior of the stick position traces. Whenever the peak was the result of maneuvering, one or both of the stick traces would always deflect just before and in the same direction as the peak. However, ascertaining that a peak was gust induced was difficult because of the very high activity of the control sticks. Ascertaining that gust was the cause of the peak required either that both stick position traces were steady or that any

movement of these traces just before the peak was in the direction opposite to that of the peak.

Like the treatment of the normal acceleration trace, the editors marked the lateral and longitudinal acceleration traces wherever they peaked outside the prescribed thresholds of ± 0. 1g. As before, to ensure inclusion of all valid peaks, the editors used levels of ± 0. 097g. Again, any peaks read within the prescribed threshold of ± 0. 1g were eliminated during the computer processing. These peaks were not identified as being maneuver- or gust-induced.

In treating the two stick position traces, the editors marked those peaks whose rise or fall was 10 percent of the full stick travel and at least 10 percent of the normal value. Each normal value depended on the mission segment. For the steady-state mission segment, the normal values were the steady values of the stick positions just before and after the peak. For the three transient mission segments (where no "steady" stick positions prevailed), an arbitrary set of normal values was chosen to approximate the stick positions during hover. The selected values are listed by aircraft serial number in Table I.

TABLE I. STICK POSITION SELECTED VALUES

Aircraft No.	Long. Cyclic Normal (%)	Collective Normal (%)
145	61.32	50.25
149	51.77	50.72
154	61.77	56.03

In each of the three transient mission segments, all traces except those for the steady stick positions were marked at each instant that the acceleration or stick position traces peaked. Because of the unsteady state prevailing during the three transient mission segments, no elapsed time was associated with the readings at these markings. The traces marked here were read only to provide corresponding parameter values in tabulations of the peak values. During the steady-state mission segment, however, all traces except that for acceleration were marked at critical points to permit an adequate time-history representation of the parameters.

DATA READING AND QUALITY CONTROL

All data points selected during the editing were measured on semiautomatic oscillogram readers, and the measurements were transcribed directly to punched cards. When all data were extracted from a flight, a printout of the cards was given to the Quality Control Section for preliminary data checking. Using standard quality control techniques, this section manually remeasured random points comprising an adequate sample and compared the measurements with those produced by the semiautomatic readers. Then, from the differences between the two sets of readings, this section established the mean and standard deviations to determine and control the desired reading accuracy. Any of the flights whose measurements did not meet the accuracy standard were reread by the semiautomatic readers. In addition to obtaining accurate values, this procedure ensured a uniform interpretation and measurement of the traces.

When all data had been processed, the mean and standard deviations were calculated for the entire data sample. Assuming a normal distribution of reading errors, 99.7 percent of the readings should be within three standard deviations of the true values. Based on average calibration values, Table II shows the mean deviation and the three standard deviations for each parameter.

DATA COMPUTATIONS

The load factor n_z for each normal acceleration peak was measured directly from the oscillogram trace. However, to present load factors for positive and negative peaks conveniently, an incremental normal load factor, Δn_z, was derived from each n_z value by using the relationship

$$\Delta n_z = n_z - 1.0$$

The following equation (see Reference 2) was used to compute density altitude, since this parameter is normally used in describing helicopter performance:

$$h_d = 145,300 \left[1 - \left(\frac{518.4\ P_a}{29.92\ (OAT + 460)} \right)^{0.235} \right]$$

Since the instrument installation correction to derive the calibrated airspeed was judged to be negligible, only indicated airspeeds were considered. For airspeeds below 110 knots, the correction is less than 4.6

knots; in addition, the correction depends on the thrust conditions of the rotor, such as those during hover and full power climb.

TABLE II. QUALITY CONTROL VALUES FOR EACH PARAMETER

Parameter	Mean Deviation	Three Standard Deviations (99.7% Accuracy Limit)
Longitudinal acceleration n_x, g	-.0001	± .03
Lateral acceleration n_y, g	-.0002	± .05
Normal acceleration n_z, g	-.0001	± .03
Airspeed, knots*	-.07	± 3.6
Altitude, feet**	-1.2	± 62
Outside air temperature, °F	-.04	± 2.2
Rotor, rpm	-.08	± 4.0
Longitudinal cyclic stick, percent	-.14	± 1.5
Collective stick, percent	-.11	± 1.2

* Computed at a 90-knot indicated airspeed
** Computed at a 1000-foot density altitude and standard temperature

Rotor rpm and outside air temperature were computed by applying linear calibrations to the trace measurements. With the displacements of the stick position trace representing the deflections of the longitudinal cyclic stick from the full-forward position and the deflection of the collective stick from the full-down position, the respective stick positions were computed from the trace measurements in units of percent of full deflection. By an approximate differentiation of the altitude trace, the rate of climb was computed continuously during the steady-state mission segment and at each position of stick or acceleration peak during the three transient mission segments. At the same time that the rate of climb was computed, the "longitudinal acceleration," or rate of change of airspeed, was derived by an approximate differentiation of the airspeed trace.

Through the following expressions, the rotor tip speed ratio (μ) and the ratio of the thrust coefficient (C_T) to the rotor solidity (σ) were each calculated as nondimensional parameters. With a consistent system of units employed, the ratio μ was calculated by

$$\mu = \frac{V}{\Omega R}$$

and the ratio C_T/σ was calculated by

$$C_T/\sigma = \frac{W}{\rho \pi R^2 (\Omega R)^2 \sigma}$$

DATA RESULTS

The data representing the 207 hours of valid flight data are presented in the form of histograms, exceedance curves, and time and occurrence tables. Because of their volume, the figures and tables making up the data presentation are contained in the appendixes. The histograms present the percentage of time spent in ranges of the various parameters. The exceedance curves indicate the number of flight hours required to equal or exceed a given parameter value. With the exception of Table III, the time tables, Tables IV through VII, cover only the steady-state mission segment. The occurrence tables, Tables VIII through XLV, show the number of peaks of a given parameter falling within ranges of this parameter and those of a second parameter. Some of the occurrence tables are further related to the single range of a third parameter or to the single ranges of both a third and a fourth parameter.

Figures 2 through 13 are histograms showing the percentage of flight time spent in ranges of the various parameters. Figure 2 shows that more than one-half of the flight time occurred in the maneuver mission segment. This expenditure of time contrasts sharply with previous flight loads studies, where most of the flight time was recorded during steady-state conditions. Therefore, the armed CH-47A was considerably more active than the cargo and transport CH-47A reported in Reference 3. This greater activity will be evidenced further in the discussion of the normal acceleration peak values. The histograms in Figure 3 give the flight profile of the armed CH-47A.

Contained within a small range, the helicopter gross weights were over 30,000 pounds during more than 75 percent of the flight time. Because of the high elevation of the terrain in the operational area, more than 95 percent of the steady flight time was spent at density altitudes exceeding 2000 feet.

Figure 6, depicting rotor rpm under steady-state conditions, shows that only a few values slightly exceeded the range from 220 to 240 rpm. As evidenced in the oscillogram of Figure 19, the highest rpm of 246 was recorded in a rapid descent during a maneuver segment when the longitudinal cyclic control stick position was at 13 percent of full travel aft. This figure also shows that the rotor rpm during the preceding ascent had fallen below 220. Tables XIV and XX further evidence the low rpm's during this ascent; they list all peaks of the stick position trace within rpm ranges below 220. These tables give no times for the parameters, since they contain data recorded during the transient parts of flight.

Figure 7 shows the percentage of time at the recorded outside air temperatures. No temperatures below 50° F were recorded.

As shown in Figure 8, for the rate of climb during steady-state conditions, the rate of climb was within ± 500 feet per minute most of the time. For the rate of climb during the transient missions, the maximum descent rate was 5202 feet per minute, which occurred during a weapons pass; the maximum ascent rate was 4173 feet per minute.

Figures 9 through 13 distribute the steady-state flight time within combined ranges of airspeed, altitude, and gross weight. The highest airspeed in steady-state flight was 135 knots; the highest in transient flight was 161 knots, which occurred during the weapons pass delineated by the oscillogram traces in Figure 20.

The exceedance curves in Figures 14, 15, and 16 show the number of hours required to reach or exceed a given positive or negative incremental maneuver load factor. These figures represent the composite data and the data breakdowns by mission segment and gross weight range. The frequency and magnitude of the load factors are highest in the maneuver mission segment. Figure 21 shows the oscillogram with the largest recorded load factor (n_z of 1.95). The corresponding airspeed was 100 knots and the gross weight was 28,027 pounds. Closely paralleling the data presented in the time tables, the curves for the weight range between 28,000 and 32,000 pounds and for the altitude range between 2000 and 5000 feet represent more than 70 percent of the n_z's. As extracted from Reference 3, Figure 22 shows the maneuver spectrum for the cargo version of the CH-47A. Comparison of this figure with Figures 14 through 16 again shows that the flight loads imposed on the armed CH-47A's were considerably greater than those on the cargo helicopters. Through both a diagram and a tabulation, Figure 17 shows the maneuver normal load factor peaks falling in ranges of the rotor tip speed ratio, μ.

Figure 18 shows the exceedance plots for the positive and negative incremental gust load factors The sparsity of the data points, due primarily to the difficulty of ascertaining gust-induced peaks with certainty, permitted only a composite presentation. A valid sample could not be derived through further breakdown of these data.

With a breakdown by gross weight range, Table III distributes the total flight time among the four mission segments. As mentioned above, the time tables in Tables IV through VII cover only the steady-state mission segment. Each of the latter tables consists of several subtables. The

heading of each subtable gives: first, the parameter whose ranges form the ordinate of the subtables; second, the parameter whose ranges form the abscissa; and third the parameter whose individual range follows immediately. Thus the times in minutes within the subtable proper give the periods spent within the three combined ranges.

Tables VIII through XXI list the number of observed peaks of either the longitudinal cyclic stick position or the collective stick position as a function of two other variables. Each table consists of several subtables. In each subtable, the ordinate gives the ranges of the peak values, and the abscissa, running immediately above the subtable proper, shows the ranges of the first related variable. Then the heading above each subtable abscissa is the individual range of the second related variable. The figures within the subtable proper represent the number of peaks in the given ordinate ranges along with the corresponding ranges of the two related variables. For example, in each subtable of Table VIII, the ordinate gives the ranges for the longitudinal cyclic stick position peaks, the abscissa gives the ranges for the steady longitudinal cyclic stick position values just before the peak occurrence, and the heading gives the range of the simultaneous steady collective stick position values. Those tables with the steady stick value as the abscissa represent the steady-state mission segment and also include the time spent in the various ranges of the steady stick values. No times are given for the tables representing the ascent, descent, or maneuver mission segments.

In Tables XXII through XXXIII, the number of observed peaks of normal acceleration, n_z, are listed as functions of up to four related variables. As in Tables VIII through XXI, the ordinates in the subtables give the ranges of the peak values, the abscissas give the ranges of the first related parameter, and the subtable headings give the individual ranges of the other related parameters. Of these tables, Tables XXII through XXVII represent gust-induced peaks; and Tables XXVIII through XXXIII, maneuver-induced peaks. Similarly, Tables XXXIV through XXXVIII and Tables XXXIX through XLIII, respectively, list the number of observed peaks of the longitudinal acceleration, n_x, and the lateral acceleration, n_y. In Tables XLIV and XLV, the normal acceleration peaks are cross referenced with the corresponding values of longitudinal acceleration and lateral acceleration, respectively.

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1. CH-47A Category II Stability and Control Tests, Technical Documentary Report 64-24, Air Force Flight Test Center, Edwards Air Force Base, California, October 1964.

2. von Mises, Richard, Theory of Flight, McGraw-Hill Book Company, Inc., New York, 1945, p. 11.

3. Braun, Joseph F., and F. Joseph Giessler, CH-47A Chinook Flight Loads Investigation Program, USAAVLABS Technical Report 66-68, July 1966.

APPENDIX I

ILLUSTRATIONS FOR DATA PRESENTATIONS

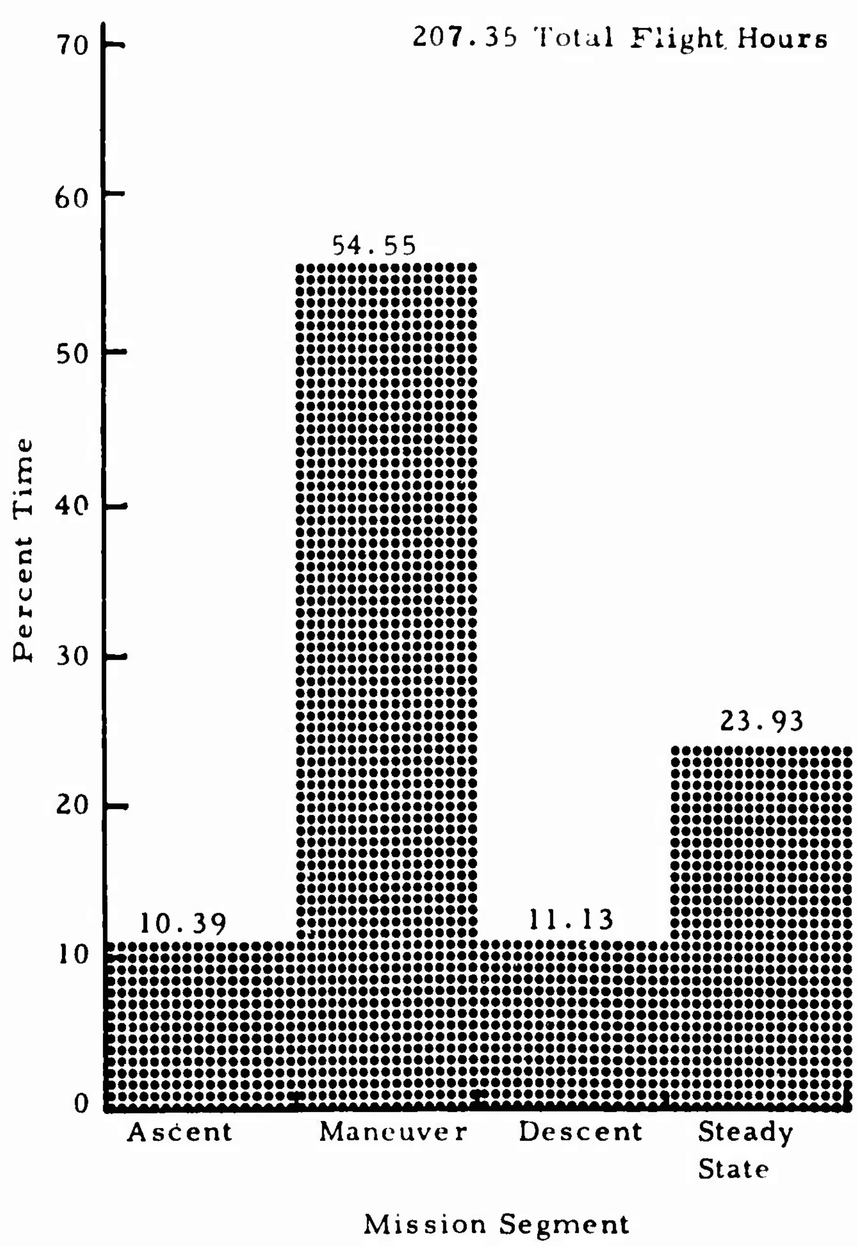
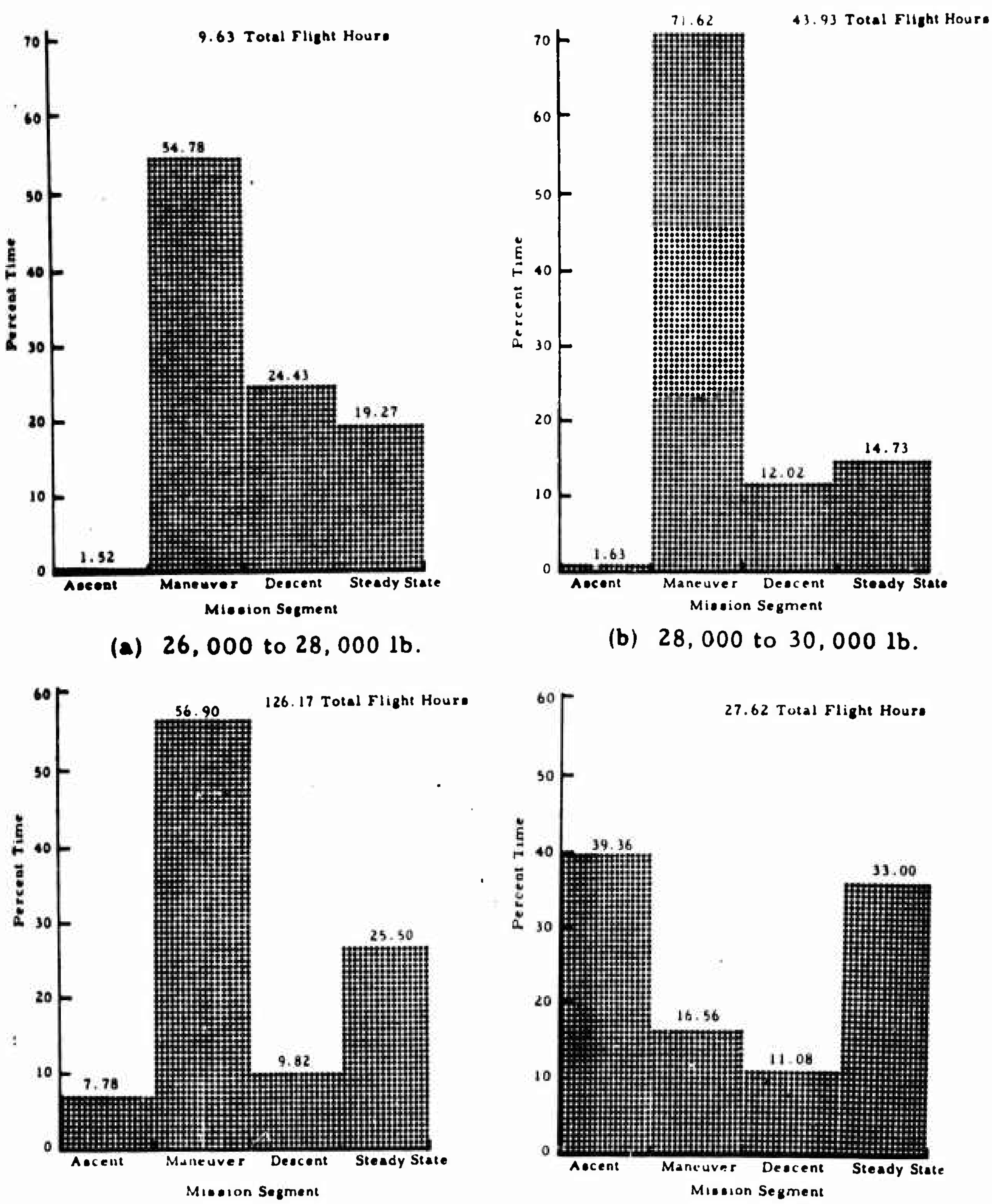


Figure 2. Percentage of Total Flight Time in Each Mission Segment



(a) 26,000 to 28,000 lb.

(b) 28,000 to 30,000 lb.

(c) 30,000 to 32,000 lb.

(d) 32,000 to 34,000 lb.

Figure 3. Flight Time in Each Gross Weight Range Broken Down by Percentage of Time in Each Mission Segment

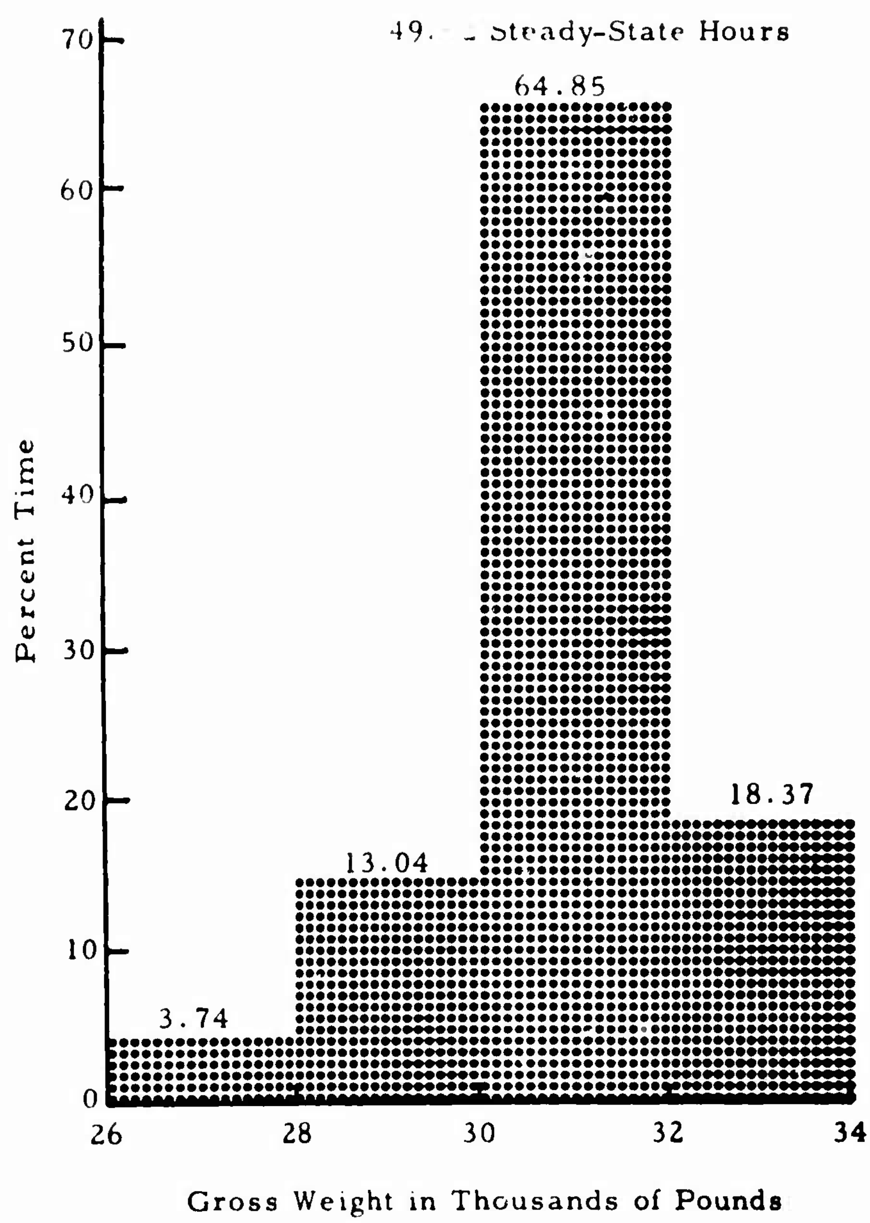


Figure 4. Percentage of Steady-State Mission Segment Flight Time in Each Gross Weight Range

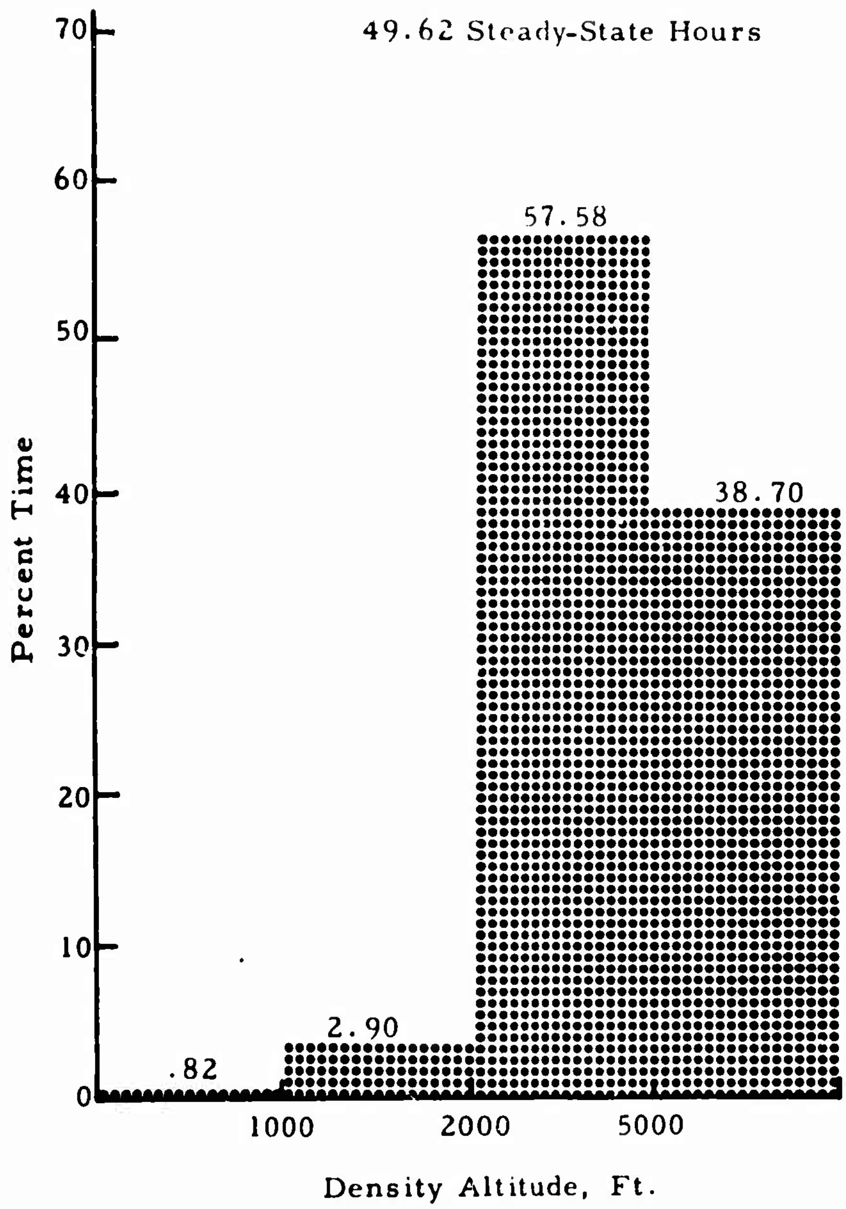


Figure 5. Percentage of Steady-State Mission Segment Flight Time in Each Density Altitude Range

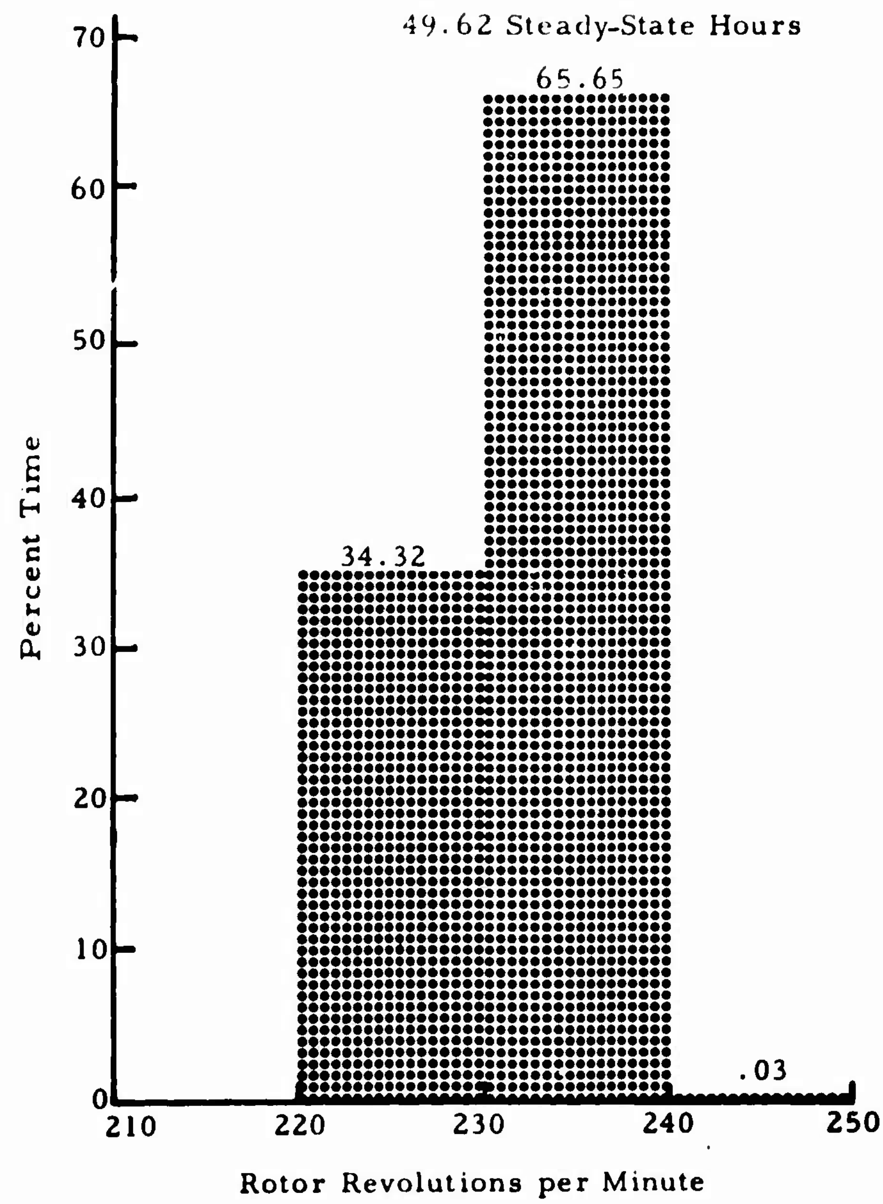


Figure 6. Percentage of Steady-State Mission Segment Flight Time in Each Rotor RPM Range

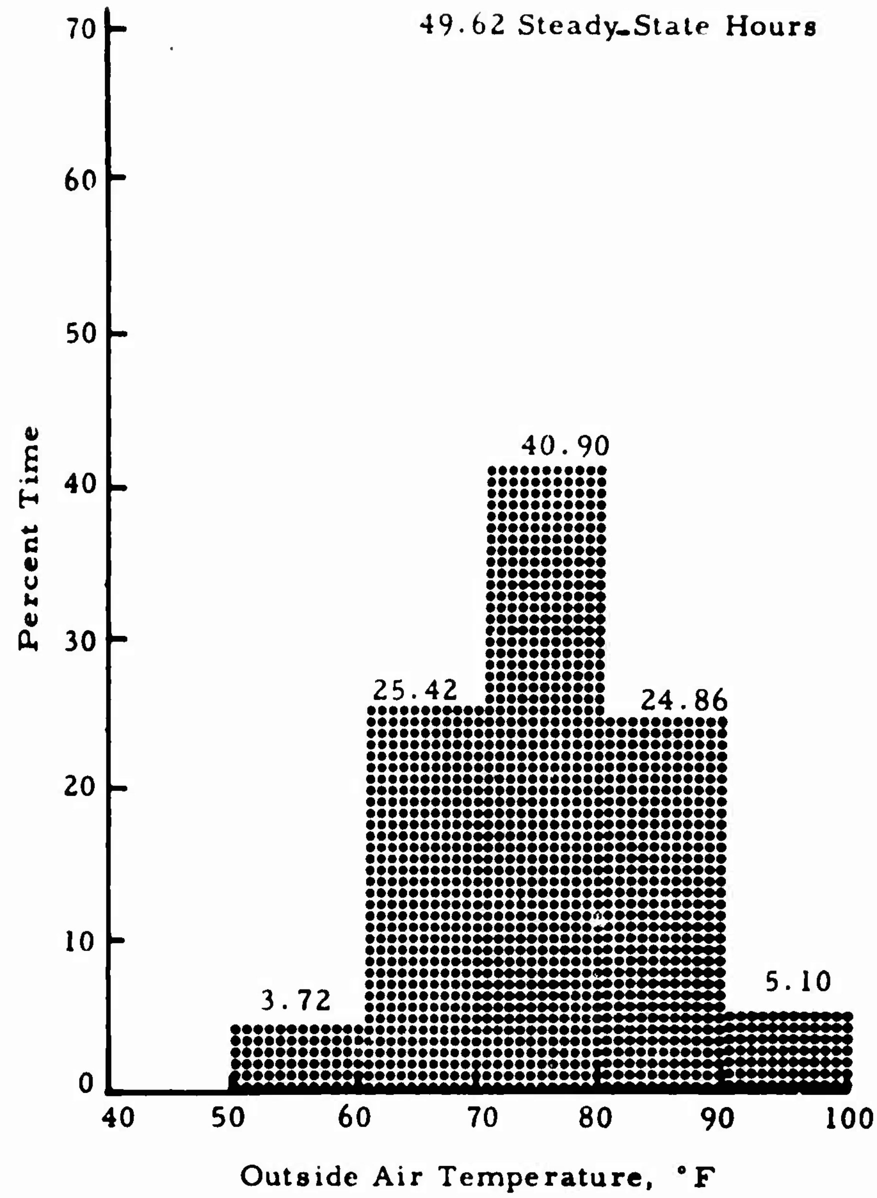


Figure 7. Percentage of Steady-State Mission Segment Flight Time in Each Outside Air Temperature Range

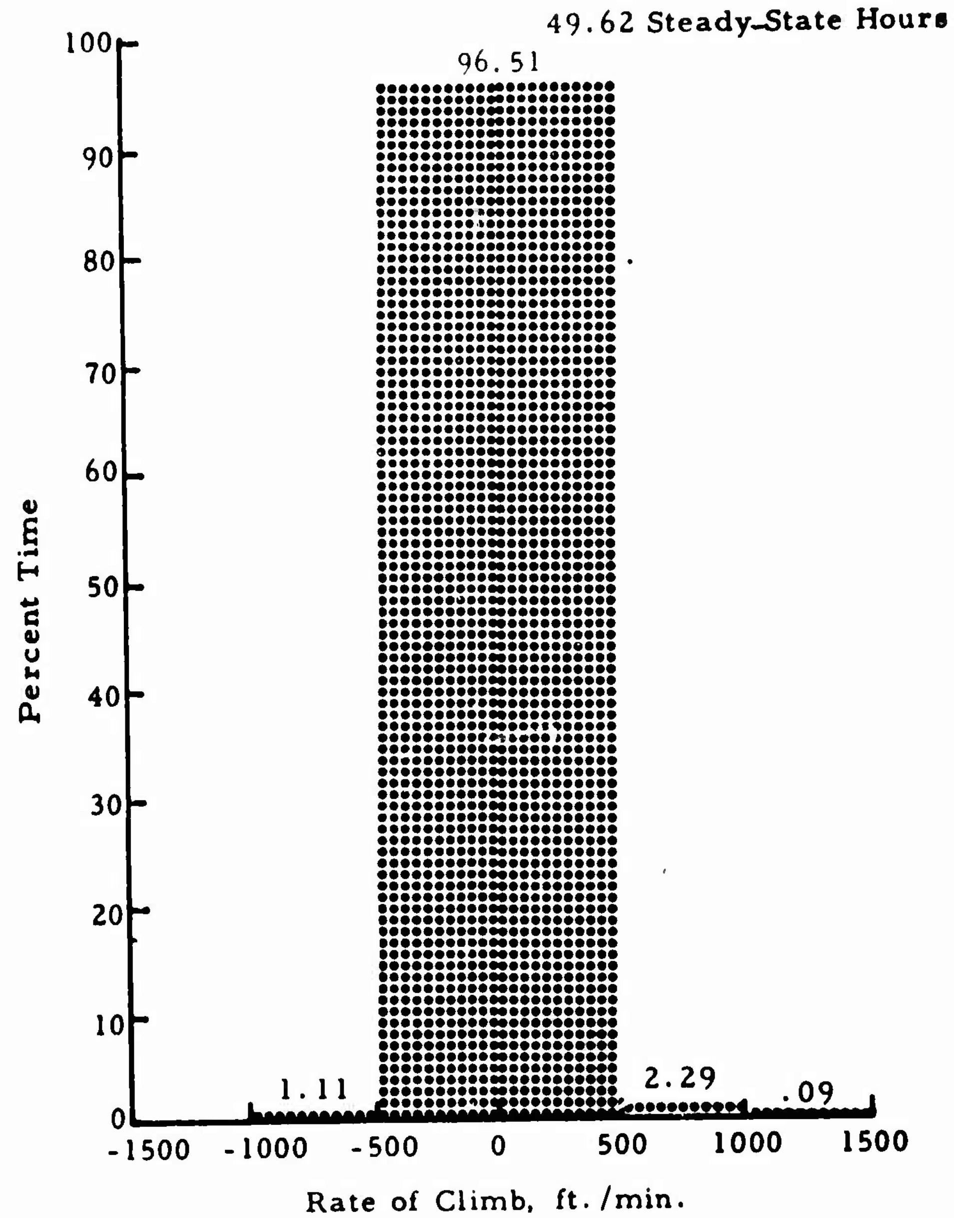


Figure 8. Percentage of Steady-State Mission Segment Flight Time in Each Rate of Climb Range

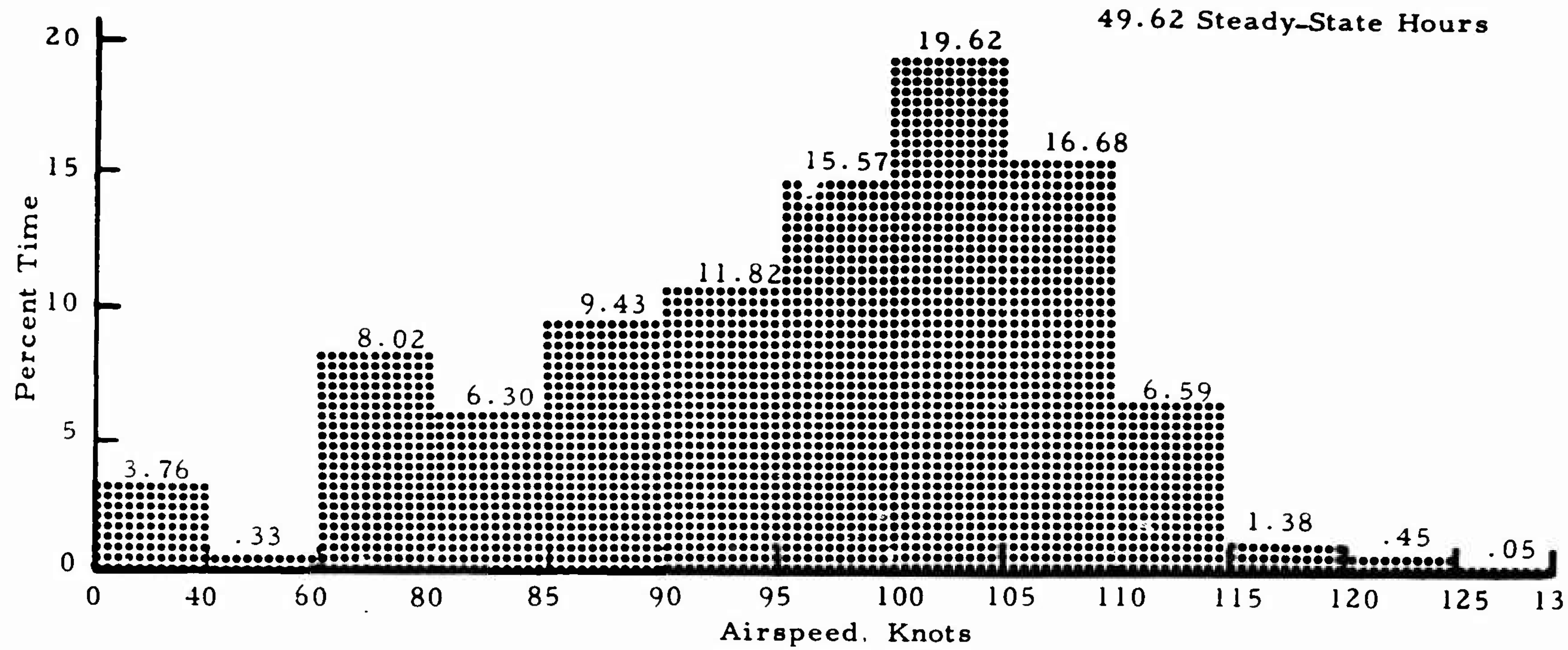


Figure 9. Percentage of Steady-State Mission Segment Flight Time in Each Airspeed Range

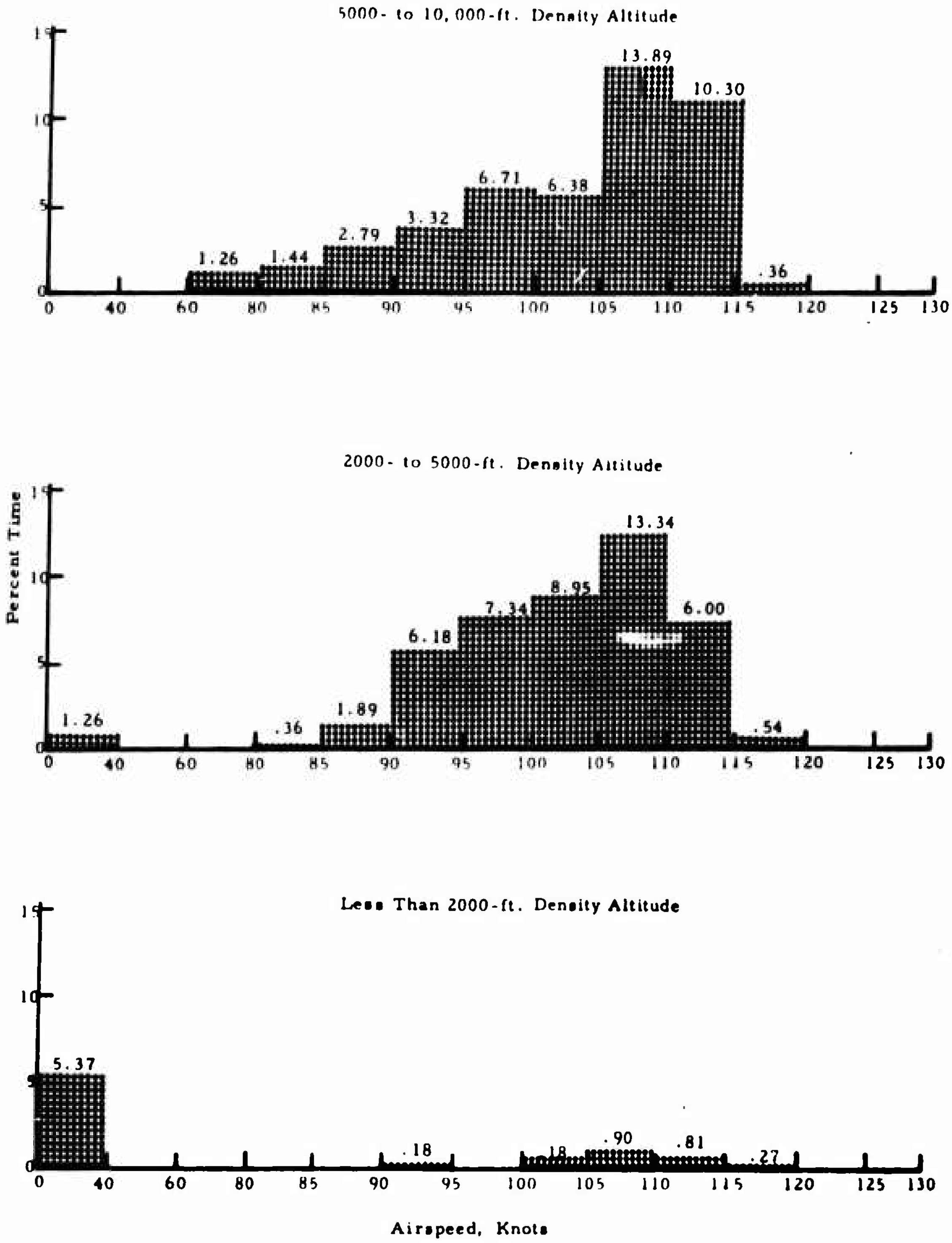


Figure 10. Time in Steady-State Mission Segment in 26,000 to 28,000-Pound Gross Weight Range Broken Down by Percentage of Time in Each Density Altitude-Airspeed Range

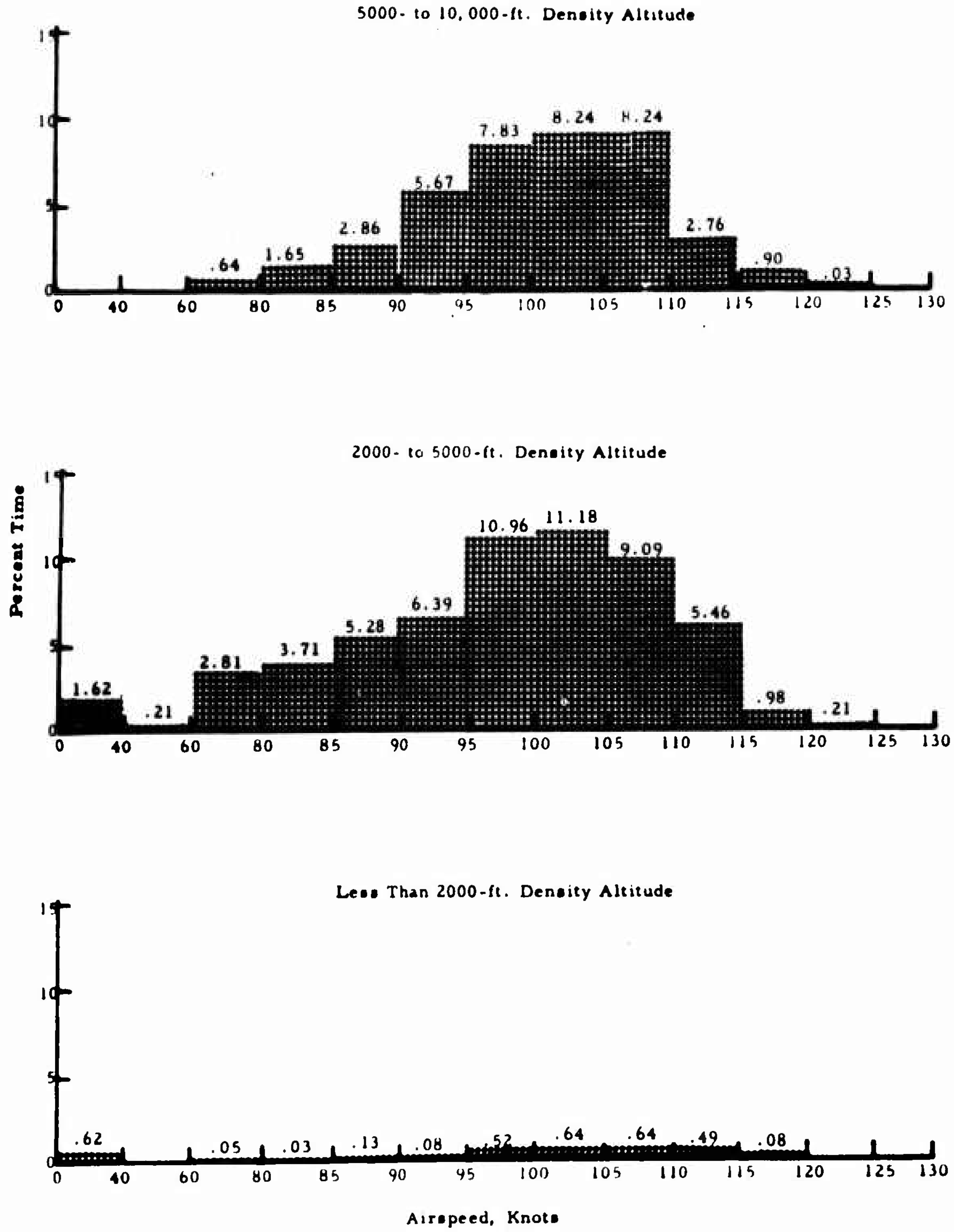


Figure 11. Time in Steady-State Mission Segment in 28,000 to 30,000-Pound Gross Weight Range Broken Down by Percentage of Time in Each Density Altitude-Airspeed Range

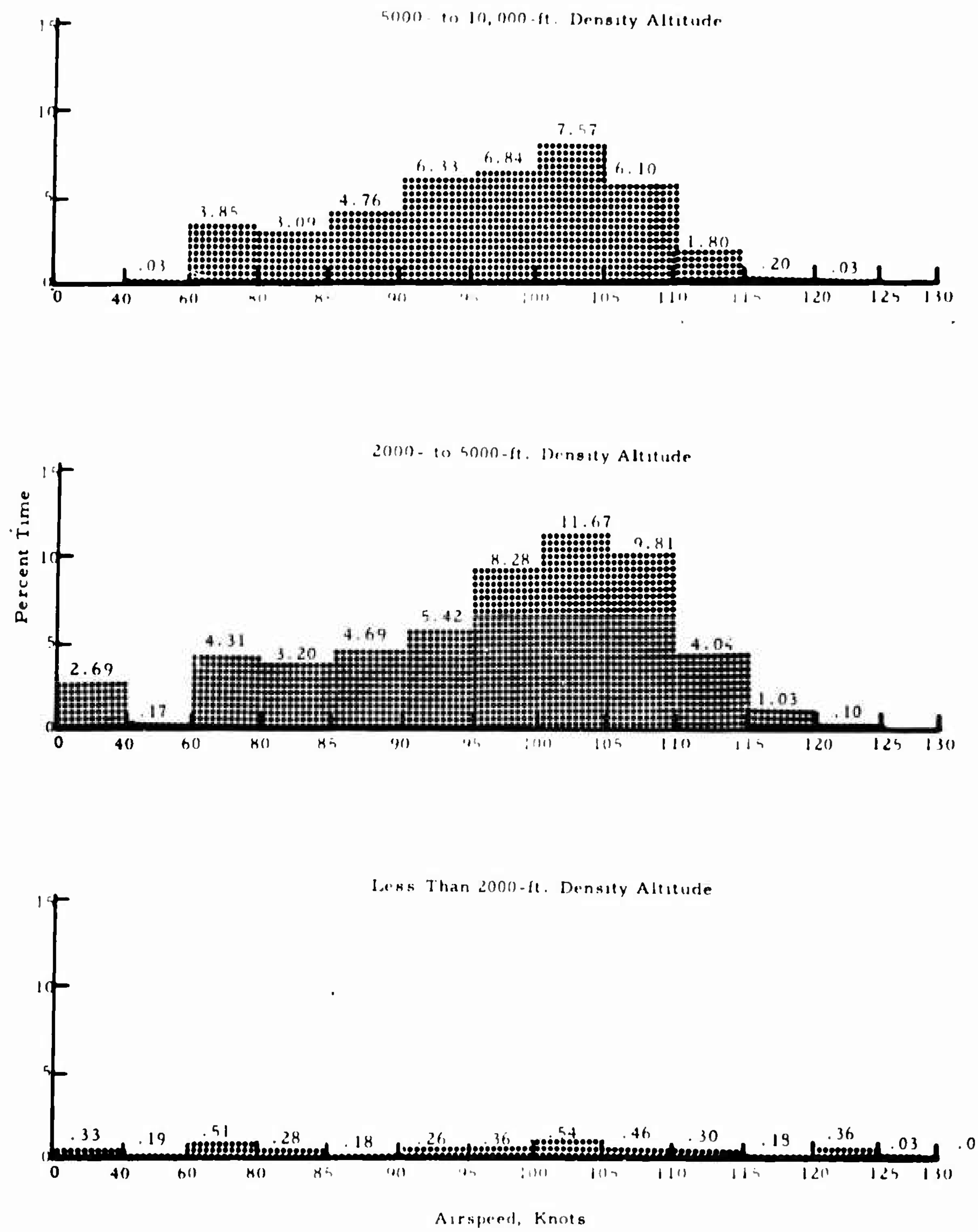


Figure 12. Time in Steady-State Mission Segment in 30,000 to 32,000-Pound Gross Weight Range Broken Down by Percentage of Time in Each Density Altitude-Airspeed Range

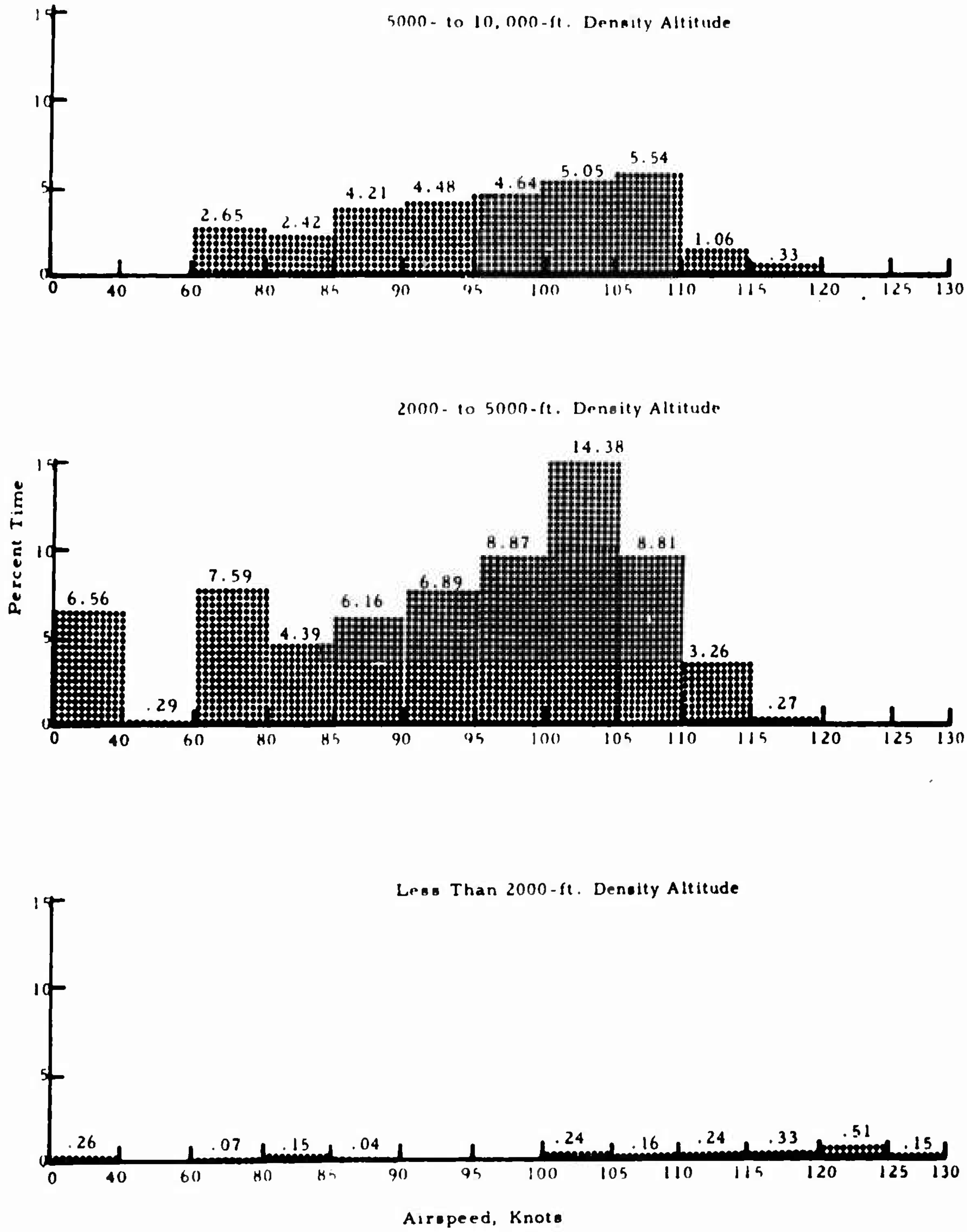
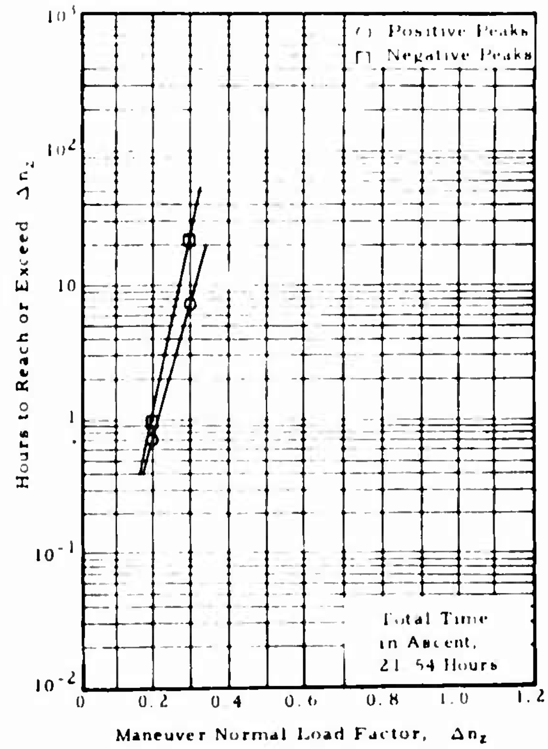
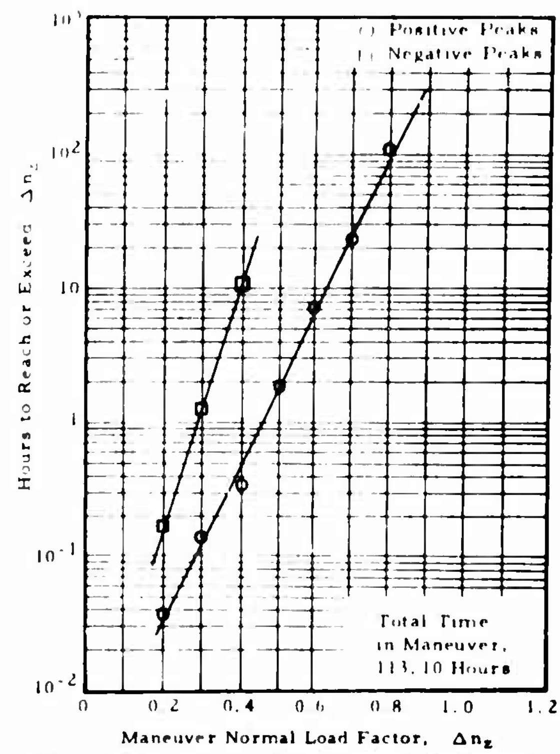


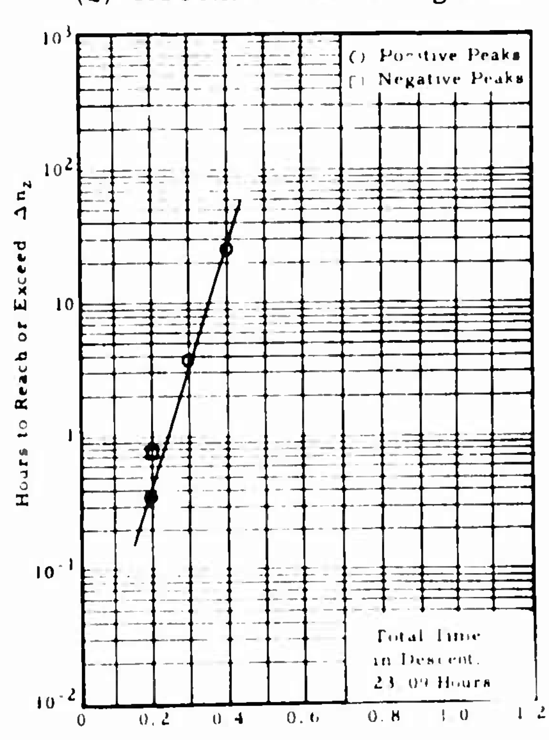
Figure 13. Time in Steady-State Mission Segment in 32,000 to 34,000-Pound Gross Weight Range Broken Down by Percentage of Time in Each Density Altitude-Airspeed Range



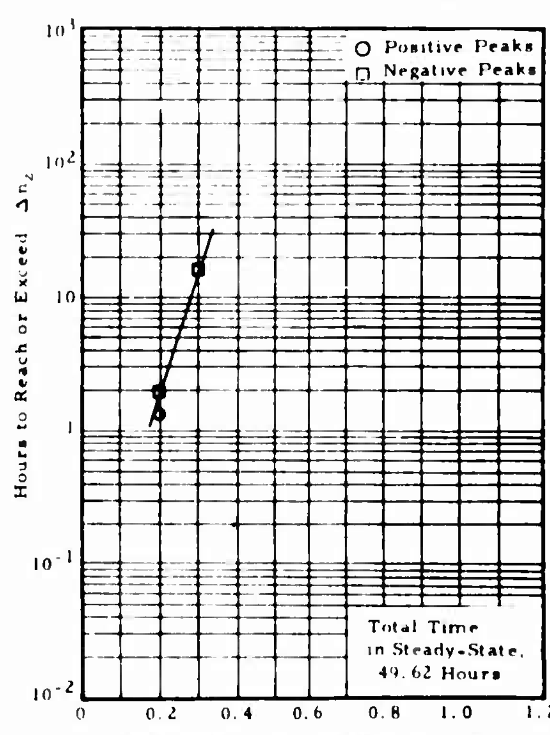
(a) Ascent Mission Segment



(b) Maneuver Mission Segment



(c) Descent Mission Segment



(d) Steady-State Mission Segment

Figure 14. Exceedance Curves for Incremental Maneuver Normal Load Factor Peaks by Mission Segment

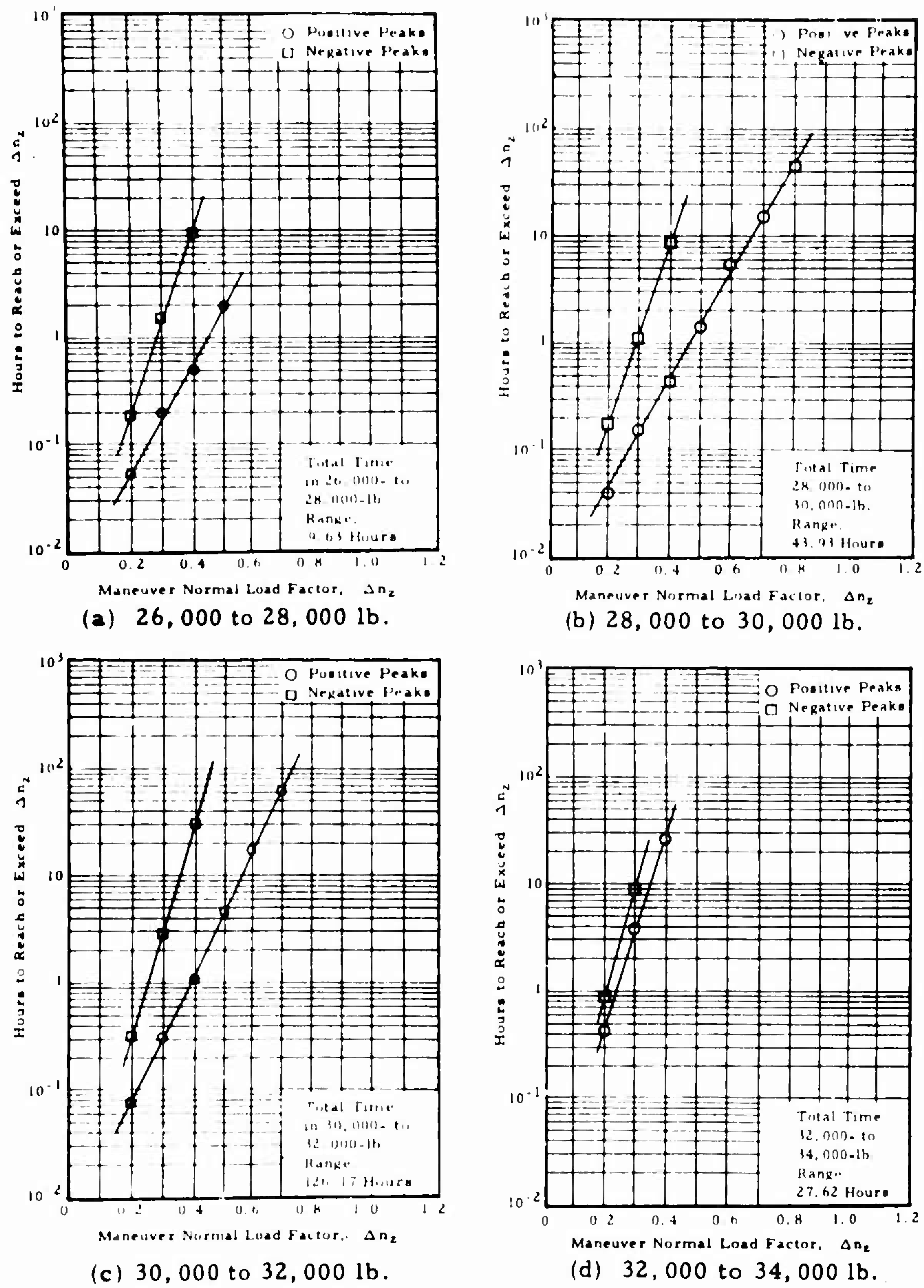


Figure 15. Exceedance Curves for Incremental Maneuver Normal Load Factor Peaks by Gross Weight Ranges

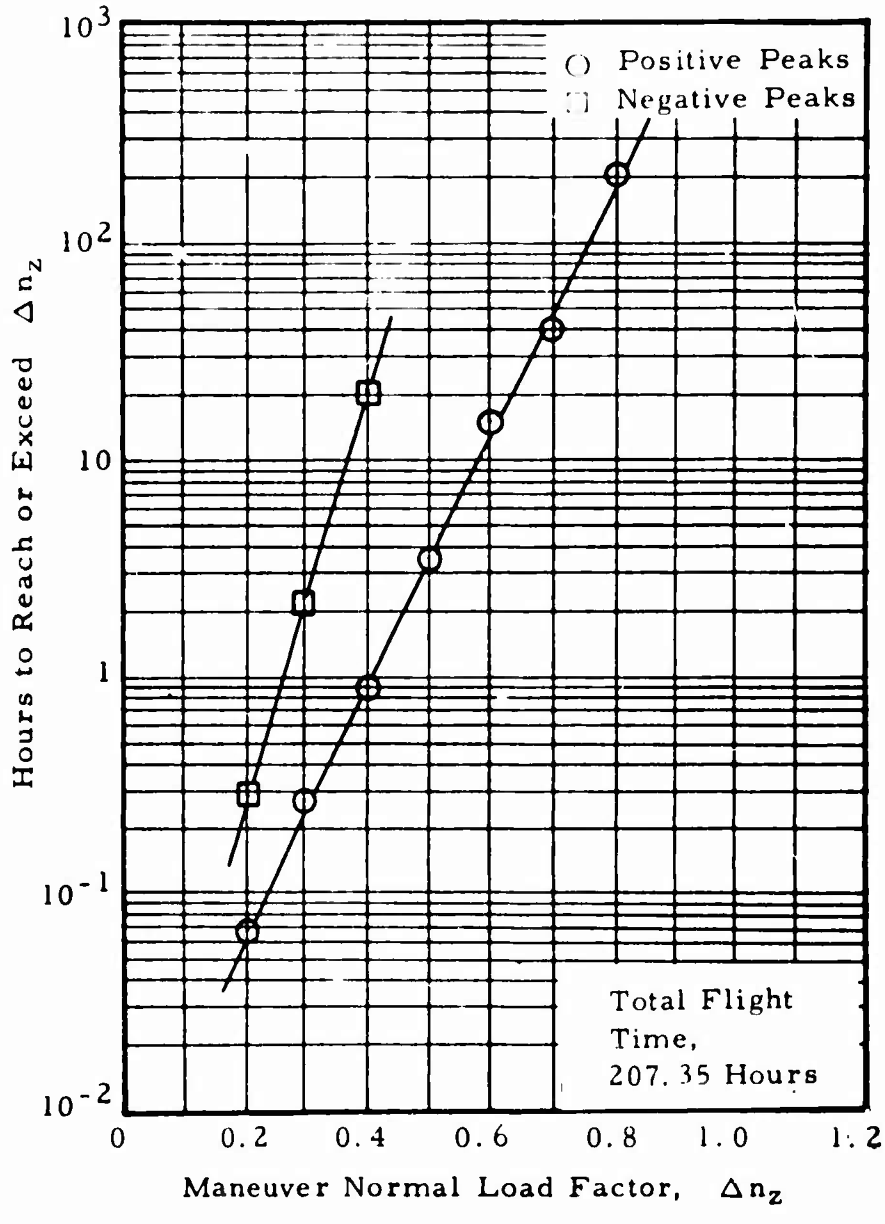
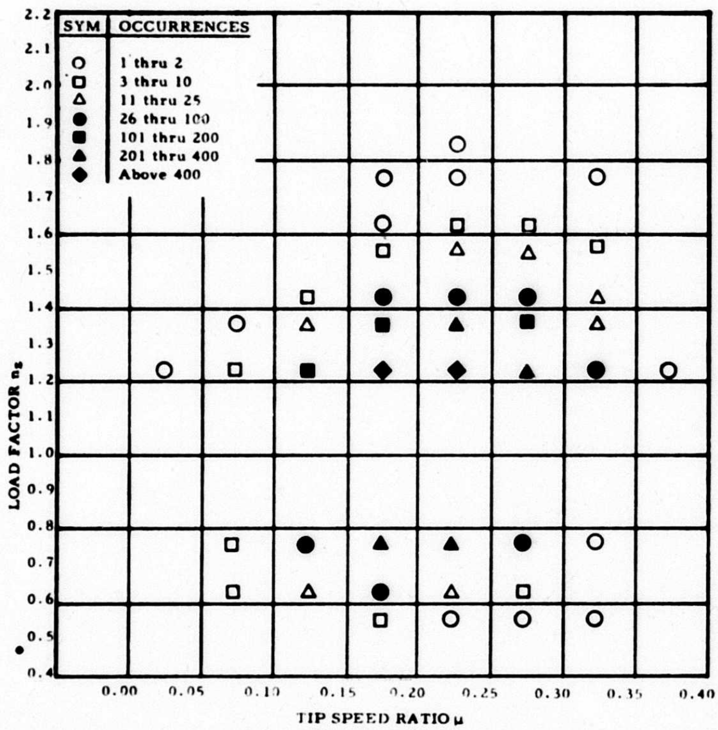


Figure 16. Exceedance Curves for the Composite of Incremental Maneuver Normal Load Factor Peaks



Load Factor n_z	Tip Speed Ratio μ									Total
	Less Than 0.00	0.00 to 0.05	0.05 to 0.10	0.10 to 0.15	0.15 to 0.20	0.20 to 0.25	0.25 to 0.30	0.30 to 0.35	0.35 to 0.40	
2.2 to 2.4										
2.0 to 2.2										
1.8 to 2.0						1				1
1.7 to 1.8					1	2		1		4
1.6 to 1.7					1	5	4			10
1.5 to 1.6					6	14	19	6		45
1.4 to 1.5				4	32	63	58	13		170
1.3 to 1.4			1	25	166	208	139	20		559
1.2 to 1.3		2	10	157	862	909	255	30	1	2226
0.8 to 1.2										
0.7 to 0.8			9	77	261	223	58	2		630
0.6 to 0.7			4	13	38	18	4			77
0.5 to 0.6					7	1	1	1		10
Total		2	24	276	1374	1444	538	73	1	3732

Figure 17. Diagram and Tabulation of Maneuver Normal Load Factor Peaks in Ranges of Rotor Tip Speed Ratio

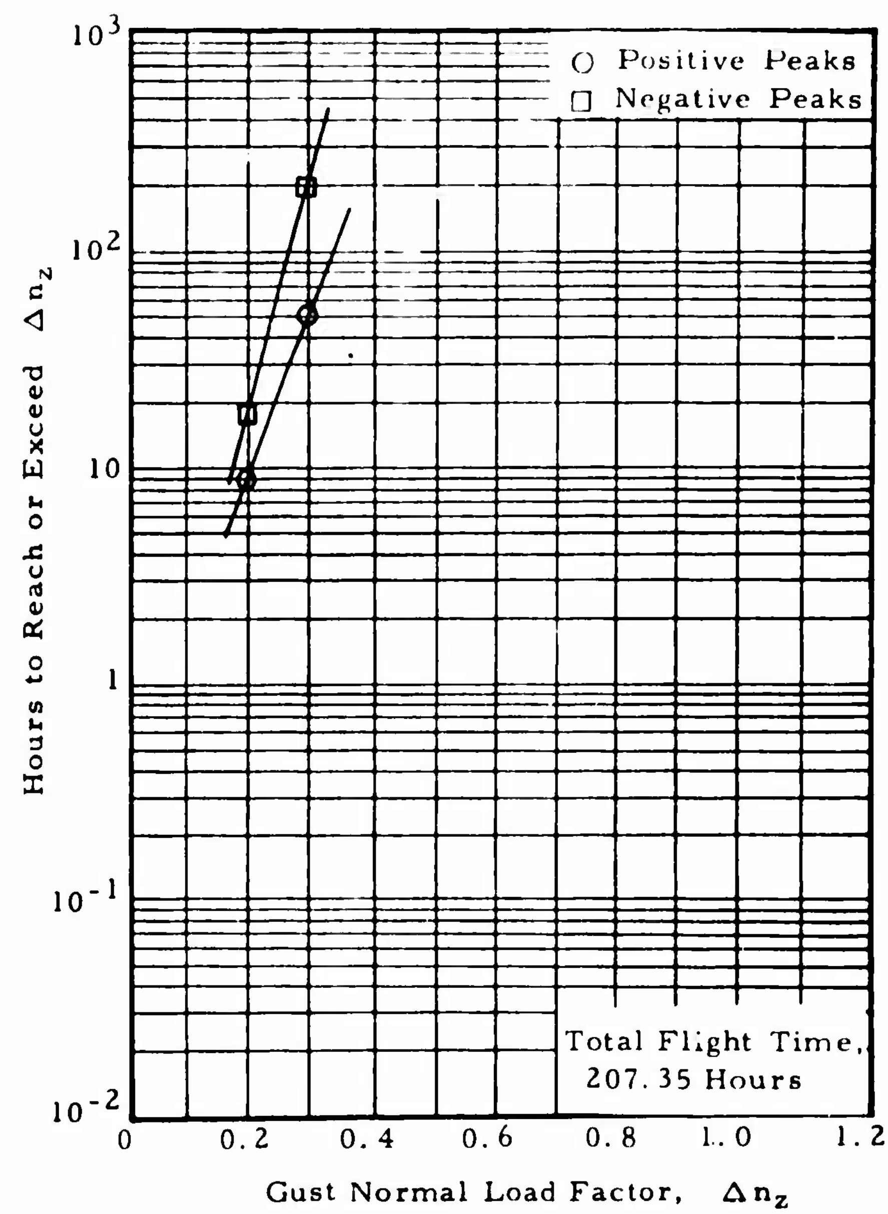
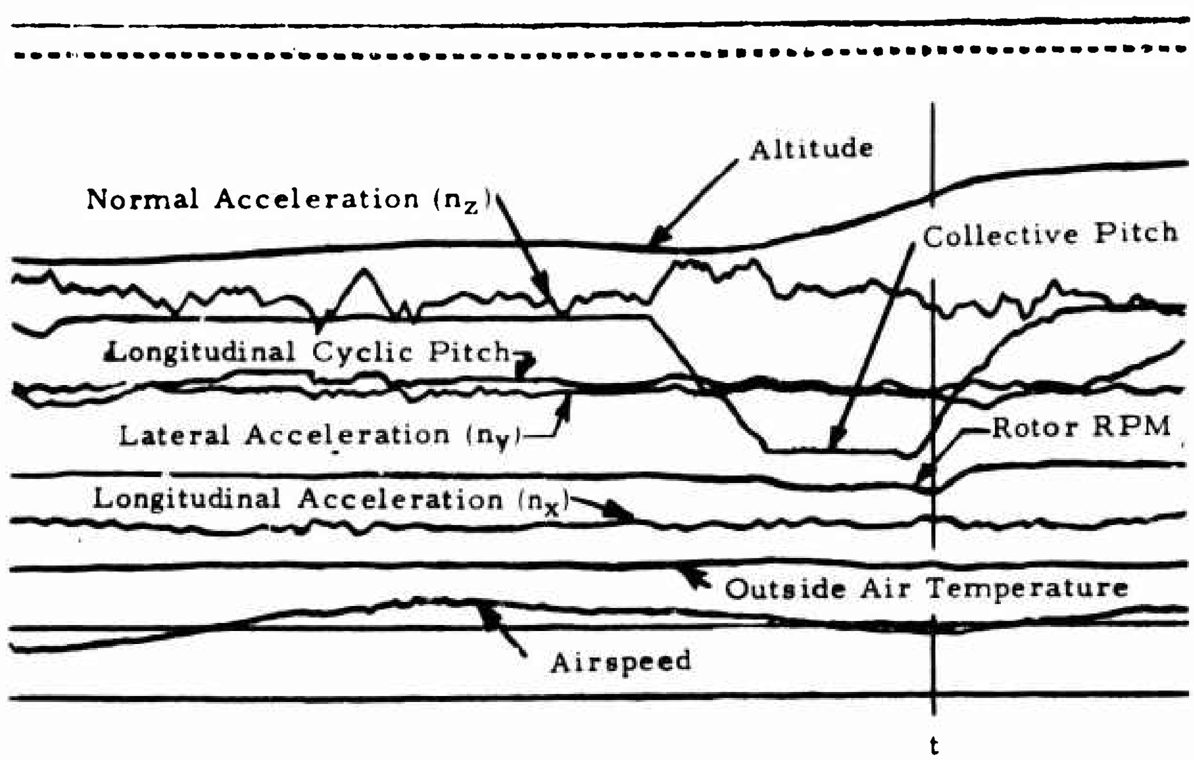


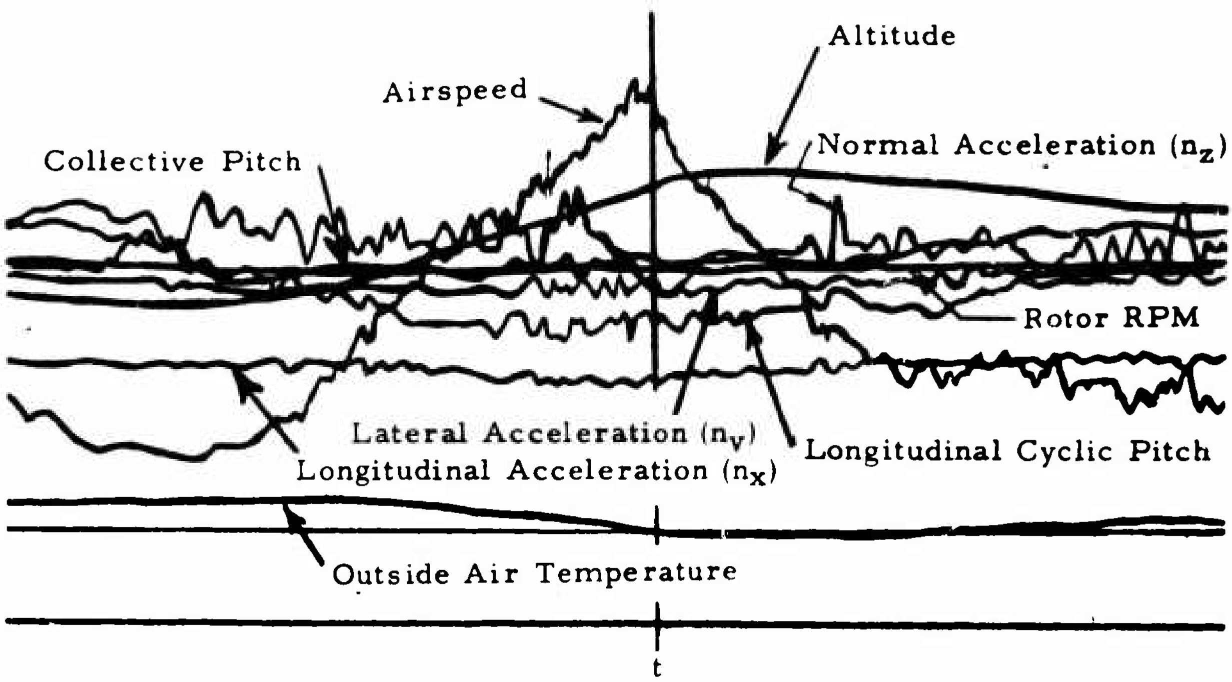
Figure 18. Exceedance Curves for Composite of Incremental Gust Normal Load Factor Peaks



Values at t:

Maximum Rotor RPM	246
Airspeed	73.6 knots
Normal Acceleration	1.04 g
Altitude	3529 ft

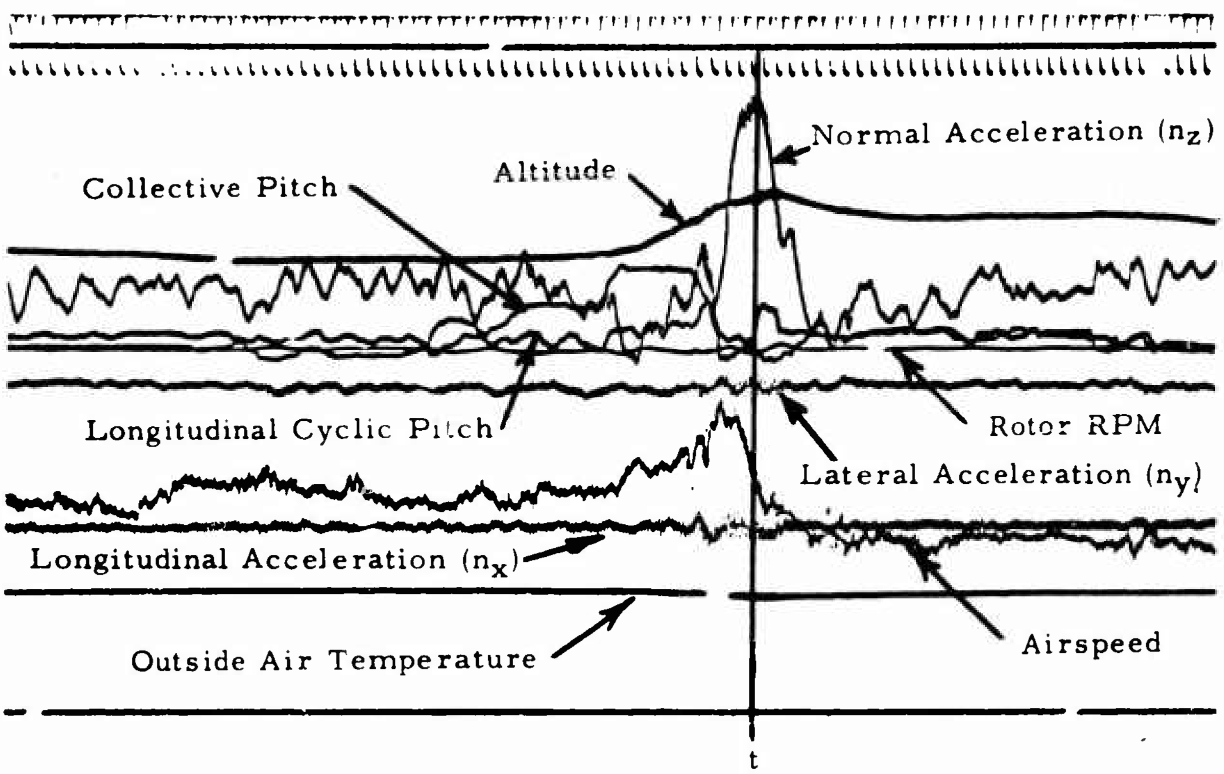
Figure 19. Maximum Rotor RPM Condition



Values at t:

Maximum Airspeed	161 knots
Weight	31, 189 lbs
Normal Acceleration	1.16 g
Rotor RPM	235
Altitude	5295 ft

Figure 20. Maximum Airspeed Condition



Values at t:

Maximum n_z	1.95 g
Airspeed	100 knots
Altitude	3243 ft
Weight	28, 027 lbs.
Rotor RPM	228

Figure 21. Maximum Normal Acceleration Condition

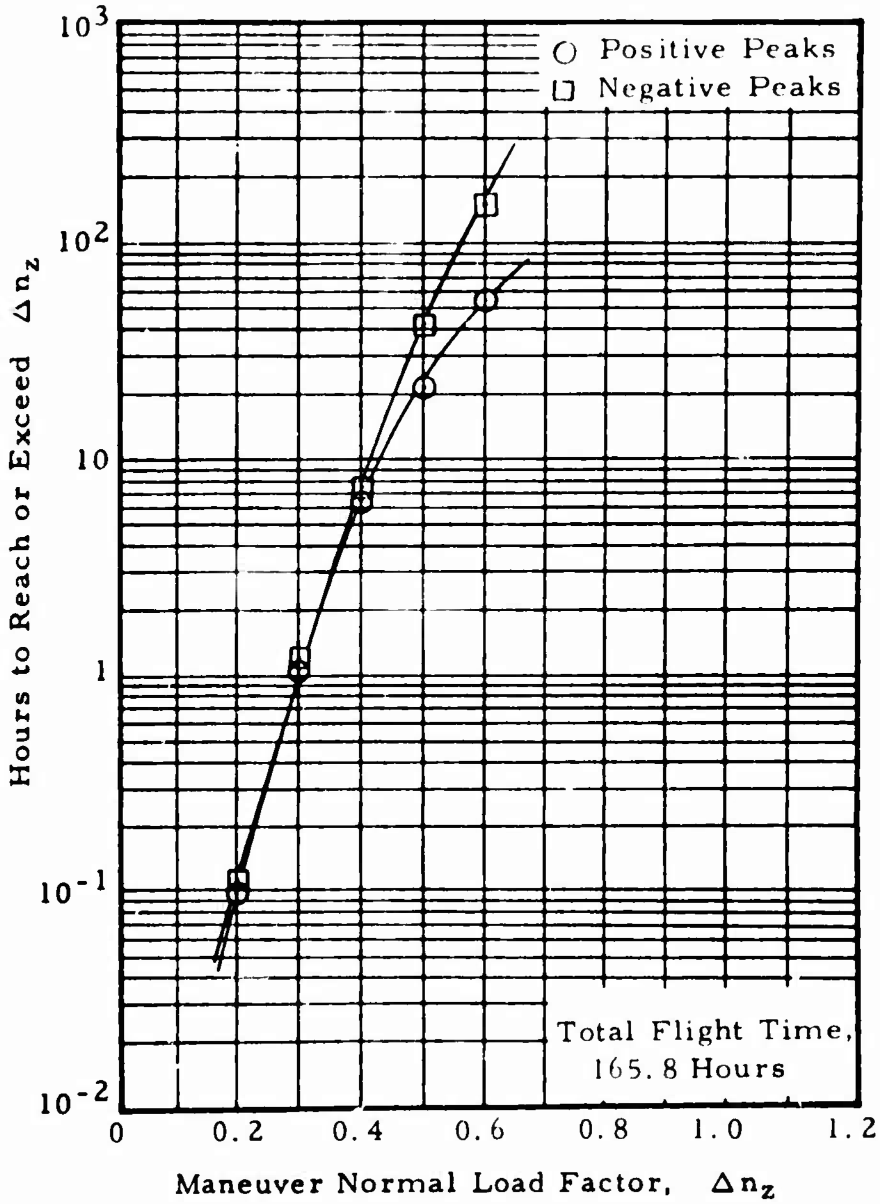


Figure 22. Plot of Maneuver Load Factor from Reference 3 Reflecting the Maneuver Spectrum for the Cargo Version of the CH-47A

APPENDIX II

TABLES FOR DATA PRESENTATION

Tables III through XLV are computer printouts.

All times in these tables were rounded off to the nearest tenth of a minute. Total times, as well as individual times, are accurate to within 0.05 minute, since the individual times comprising the respective totals were summed before the totals were rounded off. However, the addition of some printed individual times may differ from the corresponding printed total time by some fraction of a minute. Any time between 0 and up to but not including 0.05 minute was printed as "0.0," and no time measured was printed as "0." Tables having no points or time were not printed.

Table headings are arranged so that the first-mentioned parameter refers to the vertical ranges at the left of the table; the second-mentioned parameter refers to the horizontal ranges at the top of the table; where a third or fourth parameter is mentioned, it followed by its range in the heading. As an example, the heading "NZ GUST PEAKS VS VEL. BY MISS. SEG. ASCENT, ALT. LESS, WGT. 30000" indicates the number of gust n_z peaks in selected airspeed ranges for ascent, altitude below 1000 feet, and weight between 30,000 and 32,000 pounds.

With the exception of the code "LESS," the code for each range gives its lower limit. The following listing gives the range codes for all parameters:

Airspeed (knots)	
Code	Range
Less	Below 40
40	40 to 60
60	60 to 80
80	80 to 85
85	85 to 90
90	90 to 95
95	95 to 100
100	100 to 105
105	105 to 110
110	110 to 115
115	115 to 120
120	120 to 125
125	125 to 130
130	130 to 135
135	135 to 140
140	Above 140

Gust n_z and Maneuver n_z (g)	
Code	Range
Less	Below 0.2
0.2	0.2 to 0.4
0.4	0.4 to 0.5
0.5	0.5 to 0.6
0.6	0.6 to 0.7
0.7	0.7 to 0.8
0.8	0.8 to 1.2
1.2	1.2 to 1.3
1.3	1.3 to 1.4
1.4	1.4 to 1.5
1.5	1.5 to 1.6
1.6	1.6 to 1.7
1.7	1.7 to 1.8
1.8	1.8 to 2.0
2.0	2.0 to 2.2
2.2	2.2 to 2.4
2.4	Above 2.4

n_x and n_y (g)	
Code	Range
Less	Below -0.40
-0.40	-0.40 to -0.35
-0.35	-0.35 to -0.30
-0.30	-0.30 to -0.25
-0.25	-0.25 to -0.20
-0.20	-0.20 to -0.15
-0.15	-0.15 to -0.10
-0.10	-0.10 to 0.10
0.10	0.10 to 0.15
0.15	0.15 to 0.20
0.20	0.20 to 0.25
0.25	0.25 to 0.30
0.30	0.30 to 0.35
0.35	0.35 to 0.40
0.40	Above 0.40

Rate of Climb (ft/min)	
Code	Range
Less	Below -2500
-2500	-2500 to -2000
-2000	-2000 to -1500
-1500	-1500 to -1000
-1000	-1000 to -500
-500	-500 to 500
500	500 to 1000
1000	1000 to 1500
1500	1500 to 2000
2000	2000 to 2500
2500	Above 2500

Collective & Cyclic Stick Peaks (%)	
Code	Range
Less	Below -40
-40	-40 to -30
-30	-30 to -20
-20	-20 to -10
-10	-10 to 10
10	10 to 20
20	20 to 30
30	30 to 40
40	Above 40

Collective & Cyclic Stick Steady (%)	
Code	Range
Less	Below 10
10	10 to 20
20	20 to 30
30	30 to 40
40	40 to 50
50	50 to 60
60	60 to 70
70	70 to 80
80	80 to 90
90	Above 90

Tip Speed Ratio

Code	Range
Less	Below 0.00
0.00	0.00 to 0.05
0.05	0.05 to 0.10
0.10	0.10 to 0.15
0.15	0.15 to 0.20
0.20	0.20 to 0.25
0.25	0.25 to 0.30
0.30	0.30 to 0.35
0.35	Above 0.35

Weight (pounds)

Code	Range
Less	Below 20,000
20,000	20,000 to 22,000
22,000	22,000 to 24,000
24,000	24,000 to 26,000
26,000	26,000 to 28,000
28,000	28,000 to 30,000
30,000	30,000 to 32,000
32,000	Above 32,000

Rotor RPM

Code	Range
Less	Below 210
210	210 to 220
220	220 to 230
230	230 to 240
240	240 to 250
250	Above 250

Altitude (feet)

Code	Range
Less	Below 1000
1000	1000 to 2000
2000	2000 to 5000
5000	5000 to 10,000
10,000	10,000 to 15,000
15,000	15,000 to 20,000
20,000	Above 20,000

Thrust Coefficient Ratio

Code	Range
Less	Below 0.06
0.06	0.06 to 0.09
0.09	0.09 to 0.12
0.12	0.12 to 0.15
0.15	Above 0.15

Outside Air Temperature (°F)

Code	Range
Less	Below 0
0	0 to 10
10	10 to 20
20	20 to 30
30	30 to 40
40	40 to 50
50	50 to 60
60	60 to 70
70	70 to 80
80	80 to 90
90	Above 90

Airspeed Acceleration (ft/sec^2)

Code	Range
Less	Below -15
-15	-15 to -12
-12	-12 to -9
-9	-9 to -6
-6	-6 to -3
-3	-3 to 3
3	3 to 6
6	6 to 9
9	9 to 12
12	Above 12

TABLE III

FLIGHT TIME FOR MISSION SEGMENT VERSUS WEIGHT

TIME(MINUTES) FOR MISSION SEGMENT VS WEIGHT TOTAL

	LESS	20000	22000	24000	26000	28000	30000	32000	TOTAL	TOTAL(HOURS)
ASCENT					8.8	43.0	588.4	652.1	1292.4	21.5
MANUVR					326.5	1877.5	4307.8	274.4	6786.2	113.1
DESCNT					141.2	316.7	743.4	183.7	1385.1	23.1
STEADY					111.1	388.3	1930.7	546.9	2977.2	49.6
TOTAL					577.7	2635.5	7970.4	1657.3	12440.8	207.3

TABLE IV

STEADY-STATE TIME FOR ALTITUDE VERSUS AIRSPEED BY WEIGHT

TIME(MINUTES) FOR ALTITUDE VS VELOCITY BY WEIGHT 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS	6.0																6.0
1000						0.2		0.2	1.0	0.9	0.3						2.5
2000	1.4			0.4	2.1	6.9	8.2	10.0	14.9	6.7	0.6						51.1
5000			1.4	1.6	3.1	3.7	7.5	7.1	15.5	11.5	0.4						51.7
10000																	
15000																	
20000																	
TOTAL	7.4		1.4	2.0	5.2	10.8	15.7	17.3	31.4	19.0	1.3						111.3

TIME(MINUTES) FOR ALTITUDE VS VELOCITY BY WEIGHT 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS	0.6		0.1		0.5												1.3
1000	1.8		0.1	0.1		0.3	2.0	2.5	2.5	1.9	0.3						11.6
2000	6.3	0.8	10.9	14.4	20.5	24.8	42.6	43.4	35.3	21.2	3.8	0.8					224.7
5000			2.5	6.4	11.1	22.0	30.4	32.0	32.0	10.7	3.5	0.1					150.7
10000																	
15000																	
20000																	
TOTAL	8.8	0.8	13.6	20.9	32.2	47.1	75.0	77.9	69.8	33.8	7.6	0.8					388.3

TIME(MINUTES) FOR ALTITUDE VS VELOCITY BY WEIGHT 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS	4.2	2.8	4.2	0.6	0.5	1.4	0.9	1.4	1.0								17.1
1000	2.2	0.9	5.7	4.8	3.3	3.6	6.1	9.1	7.9	5.7	3.5	7.0	0.6	0.2			60.4
2000	52.0	3.3	83.3	61.7	90.5	104.6	159.8	275.2	189.2	78.0	19.9	2.0					1069.5
5000		0.5	74.3	59.7	91.9	122.2	132.1	146.0	117.7	34.8	3.8	0.6					783.8
10000																	
15000																	
20000																	
TOTAL	58.4	7.6	167.5	126.8	185.9	231.9	299.0	301.7	315.9	118.4	27.2	9.6	0.6	0.2			1930.8

TIME(MINUTES) FOR ALTITUDE VS VELOCITY BY WEIGHT 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
1000	1.4		0.4	0.8	0.2			1.3	0.9	1.3	1.8	2.8	0.8				11.7
2000	35.9	1.6	41.5	24.0	33.7	37.7	48.5	78.6	48.2	17.8	1.5						369.0
5000			14.5	13.2	23.0	24.5	25.4	27.6	30.3	5.8	1.8						166.2
10000																	
15000																	
20000																	
TOTAL	37.3	1.6	56.4	38.0	57.0	62.2	74.0	107.4	79.4	24.9	5.2	2.8	0.8				547.0

TABLE IV - contd.

TIME(MINUTES) FOR ALTITUDE VS VELOCITY BY WEIGHT TOTAL

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS	10.8	2.8	4.3	0.6	1.0	1.4	0.9	1.4	1.0								24.4
1000	5.5	0.5	6.2	5.8	3.3	4.1	8.0	13.1	12.3	9.[illegible]	6.0	9.8	1.4	0.2			86.2
2000	95.6	5.8	135.7	100.5	146.8	174.0	259.1	357.1	287.6	123.7	25.7	2.8					1714.4
5000		0.5	92.7	80.9	129.2	172.4	195.5	212.7	195.5	62.8	9.5	0.7					1152.3
10000																	
15000																	
20000																	
TOTAL	111.9	10.0	238.9	187.7	280.2	351.9	463.5	584.3	496.5	196.[illegible]	41.2	13.3	1.4	0.2			2977.2

TABLE V
STEADY-STATE TIME FOR COLLECTIVE STICK POSITION VERSUS CYCLIC STICK POSITION BY RATE OF CLIMB

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB -1500

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20											
30											
40											
50						0.1					0.1
60											
70											
80											
90											
TOTAL						0.1					0.1

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB -1000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20											
30											
40				1.3	8.8	1.6		0.1			11.8
50				2.6	10.6	6.4	0.3	0.1			20.0
60				0.2	0.3	0.5	0.4				1.4
70											
80											
90											
TOTAL				4.0	19.7	8.5	0.7	0.2			33.1

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB -500

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20						0.5					0.5
30					0.4	1.7	0.1				2.2
40				10.1	440.3	237.8	6.9	0.6			695.8
50				138.5	1142.1	668.0	49.3	0.8			1999.0
60				43.0	54.9	65.7	10.4	0.6			174.7
70				0.9	0.2						1.1
80											
90											
TOTAL				192.5	1638.1	973.7	66.8	2.0			2873.1

TABLE V - contd.

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB 500

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20											
30											
40					1.1	1.1					2.2
50				1.5	35.5	17.5		0.2			54.8
60				1.0	7.6	1.8	0.7				11.0
70											
80											
90											
TOTAL				2.5	44.2	20.4	0.7	0.2			68.0

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB 1000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20											
30											
40											
50				0.2	1.0	0.1					1.3
60					1.2	0.1					1.3
70											
80											
90											
TOTAL				0.2	2.2	0.2					2.7

TIME(MINUTES) FOR COLLECTIVE VS CYCLIC BY CLIMB TOTAL

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
10											
20						0.5					0.5
30					0.4	1.7	0.1				2.2
40				11.4	450.3	240.5	6.9	0.7			709.8
50				142.8	1189.4	692.2	49.7	1.1			2075.2
60				44.2	64.0	68.1	11.5	0.6			188.4
70				0.9	0.2						1.1
80											
90											
TOTAL				199.3	1704.3	1002.9	68.2	2.5			2977.2

TABLE VI
STEADY-STATE TIME FOR ROTOR RPM VERSUS RATE OF CLIMB BY OUTSIDE AIR TEMPERATURE

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE 50

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220						35.5	0.9					36.3
230					1.0	70.5	3.0					74.5
240												
250												
TOTAL					1.0	106.0	3.8					110.8

TABLE VI - contd.

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE 60

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220				0.1	1.4	229.7	3.8	0.1				235.1
230					6.0	509.4	5.6	0.1				521.1
240						0.6						0.6
250												
TOTAL				0.1	7.4	739.7	9.4	0.2				756.8

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE 70

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220					2.4	421.7	6.9	0.8				431.7
230					12.6	760.3	12.5	0.5				786.0
240						0.1						0.1
250												
TOTAL					15.0	1182.1	19.4	1.3				1217.8

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE 80

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220					2.4	228.0	9.2	0.2				239.9
230					6.1	475.8	17.8	0.4				500.1
240						0.1						0.1
250												
TOTAL					8.5	703.9	27.0	0.6				740.0

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE 90

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220					1.0	72.1	5.6	0.2				78.9
230					0.2	69.7	2.8	0.3				73.0
240												
250												
TOTAL					1.2	141.7	8.4	0.5				151.8

TIME(MINUTES) FOR RPM VS CLIMB BY TEMPERATURE TOTAL

	LESS	-2500	-2000	-1500	-1000	-500	500	1000	1500	2000	2500	TOTAL
LESS												
210												
220				0.1	7.2	986.9	26.3	1.3				1021.9
230					25.9	1885.6	41.7	1.3				1954.6
240						0.8						0.8
250												
TOTAL				0.1	33.1	2873.3	68.0	2.7				2977.2

TABLE VII
STEADY-STATE TIME FOR C_T/σ VERSUS μ BY RATE OF CLIMB

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB -1500

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12										
0.15						0.1				0.1
TOTAL						0.1				0.1

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB -1000

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12					0.2	1.0	0.1			1.3
0.15		0.7	0.3		3.0	18.9	8.9			31.9
TOTAL		0.7	0.3		3.2	19.9	9.0			33.1

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB -500

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12	4.2	5.4	0.7	0.6	8.1	27.8	6.6			53.5
0.15	22.7	66.4	11.6	12.5	384.2	1696.5	625.7	0.2		2819.8
TOTAL	27.0	71.8	12.4	13.1	392.3	1724.3	632.3	0.2		2873.3

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB 500

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12					0.2	0.5				0.7
0.15	0.1	0.4		0.5	22.0	33.1	11.3			67.3
TOTAL	0.1	0.4		0.5	22.1	33.6	11.3			68.0

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB 1000

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12										
0.15					1.4	0.8	0.5			2.7
TOTAL					1.4	0.8	0.5			2.7

TIME(MINUTES) FOR CT/S VERSUS MU BY CLIMB TOTAL

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
LESS										
0.06										
0.09										
0.12	4.2	5.4	0.7	0.6	8.4	29.3	6.7			55.4
0.15	22.9	67.5	11.9	13.0	410.6	1749.4	646.4	0.2		2921.8
TOTAL	27.1	72.5	12.7	13.6	419.1	1778.7	653.1	0.2		2977.2

TABLE VIII
CYCLIC STICK PEAKS VERSUS CYCLIC STICK STEADY BY COLLECTIVE STICK STEADY

CYCLIC PEAKS VS CYCLIC STEADY BY COLL. STEADY 20

	LESS	1C	20	30	4C	50	6C	70	80	90	TOTAL
LESS											
-40											
-30											
-2C											
-10						1					1
1C											
2C											
30											
4C											
TOTAL						1					1
TIPE	0.	0.	0.	0.	C.	0.5	C.	0.	0.	0.	0.5

CYCLIC PEAKS VS CYCLIC STEADY BY COLL. STEADY 30

	LESS	1C	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-1C					1						1
1C											
20											
30											
40											
TOTAL					1						1
TIPE	0.	0.	0.	0.	C.4	1.7	0.1	0.	0.	0.	2.2

CYCLIC PEAKS VS CYCLIC STEADY BY COLL. STEADY 40

	LESS	1C	20	30	40	50	60	70	80	90	TOTAL
LESS											
-4C											
-30											
-20											
-1C					2	2	2				6
1C						1	1				2
2C											
30											
4C											
TOTAL					2	3	3				8
TIPE	0.	0.	0.	11.4	45C.3	240.5	6.9	0.7	0.	0.	709.8

CYCLIC PEAKS VS CYCLIC STEADY BY COLL. STEADY 50

	LESS	1C	20	30	40	50	60	70	80	90	TOTAL
LESS											
-4C											
-3C											
-20											
-10					2	4	1	1			8
10						1	3				4
2C											
30											
40											
TOTAL					2	5	4	1			12
TIPE	0.	0.	0.	142.8	1189.4	692.2	49.7	1.1	0.	0.	2075.2

CYCLIC PEAKS VS CYCLIC STEADY BY COLL. STEADY 60

	LESS	1C	20	30	40	50	60	70	80	90	TOTAL
LESS											
-4C											
-30											
-20											
-1C							1				1
1C											
20											
30											
40											
TOTAL							1				1
TIPE	0.	0.	0.	44.2	64.C	68.1	11.5	0.6	0.	0.	188.4

TABLE IX
CYCLIC STICK PEAKS VERSUS CYCLIC STICK STEADY BY DENSITY ALTITUDE

CYCLIC PEAKS VS CYCLIC STEADY BY ALTITUDE LESS

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					2	1	2				5
10						1	1				2
20											
30											
40											
TOTAL					2	2	3				7
TIME	0.	0.	0.	0.	9.3	10.3	4.2	0.6	0.	0.	24.4

CYCLIC PEAKS VS CYCLIC STEADY BY ALTITUDE 1000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10						1					1
10											
20											
30											
40											
TOTAL						1					1
TIME	0.	0.	0.	0.	41.0	44.9	0.3	0.	0.	0.	86.2

CYCLIC PEAKS VS CYCLIC STEADY BY ALTITUDE 2000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					3	5	2	1			11
10						1	3				4
20											
30											
40											
TOTAL					3	6	5	1			19
TIME	0.	0.	0.	143.1	1061.0	479.8	28.5	1.9	0.	0.	1714.4

TABLE X
CYCLIC STICK PEAKS VERSUS CYCLIC STICK STEADY BY AIRSPEED

CYCLIC PEAKS VS CYCLIC STEADY BY VELOCITY LESS

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					4	6	4	1			15
10						2	4				6
20											
30											
40											
TOTAL					4	8	8	1			21
TIME	0.	0.	0.	0.1	18.8	67.6	22.9	2.5	0.	0.	111.9

TABLE X - contd.

CYCLIC PEAKS VS CYCLIC STEADY BY VELOCITY 40

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10						1					1
10											
20											
30											
40											
TOTAL						1					1
TIME	0.	0.	0.	0.2	3.6	6.1	0.	0.	0.	0.	10.0

CYCLIC PEAKS VS CYCLIC STEADY BY VELOCITY 100

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					1						1
10											
20											
30											
40											
TOTAL					1						1
TIME	0.	0.	0.	11.5	416.9	135.7	2.2	0.	0.	0.	566.3

TABLE XI
CYCLIC STICK PEAKS VERSUS CYCLIC STICK STEADY BY ROTOR RPM

CYCLIC PEAKS VS CYCLIC STEADY BY RPM 220

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					1	5	1	1			8
10						1					1
20											
30											
40											
TOTAL					1	6	1	1			9
TIME	0.	0.	0.	101.7	555.7	356.1	7.4	0.9	0.	0.	1021.9

CYCLIC PEAKS VS CYCLIC STEADY BY RPM 210

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					4	2	3				9
10						1	4				5
20											
30											
40											
TOTAL					4	3	7				14
TIME	0.	0.	0.	97.6	1148.6	646.1	60.7	1.6	0.	0.	1954.6

TABLE XI - contd.

CYCLIC PEAKS VS CYCLIC STEADY BY RPM TOTAL

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					5	7	4	1			17
10						2	4				6
20											
30											
40											
TOTAL					5	9	8	1			23
TIME	0.	0.	0.	199.3	1704.3	1002.9	68.2	2.5	0.	0.	2977.2

TABLE XII
CYCLIC STICK PEAKS VERSUS AIRSPEED ACCELERATION BY MISSION SEGMENT

CYCLIC PEAKS VS ACCELERATION BY MISSION SEGMENT ASCENT

	LESS	-15.0	-12.0	-9.0	-6.0	-3.0	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40												
-30					1	2						3
-20					2	150	2	2				156
-10					1	129	4	1				135
10						36	3					39
20												
30												
40												
TOTAL					4	317	9	3				333

CYCLIC PEAKS VS ACCELERATION BY MISSION SEGMENT MANUVR

	LESS	-15.0	-12.0	-9.0	-6.0	-3.	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40					1	3						4
-30				3	6	115	29	6				159
-20			1	9	34	1216	106	24	3			1393
-10			1	13	58	638	46	11				767
10			3	12	84	519	43	2				663
20				2	3	19	4					28
30					1							1
40												
TOTAL			5	39	187	2510	228	43	3			3015

CYCLIC PEAKS VS ACCELERATION BY MISSION SEGMENT DESCNT

	LESS	-15.0	-12.0	-9.0	-6.0	-3.0	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40												
-30						73						73
-20				1	3	587						591
-10					4	142	2					148
10					2	62	1					65
20						1						1
30												
40												
TOTAL				1	9	865	3					878

TABLE XIII
CYCLIC STICK PEAKS VERSUS AIRSPEED
BY MISSION SEGMENT

CYCLIC PEAKS VS VELOCITY BY MISSION SEGMENT ASCENT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40																	
-30			1		1	1											3
-20	31	5	33	17	13	17	16	11	8	4	1						156
-10	60	12	36	8	6	3	6	2	2								135
10	17	2	13	4	1	1					1						39
20																	
30																	
40																	
TOTAL	108	15	83	29	21	22	22	13	10	4	2						333

CYCLIC PEAKS VS VELOCITY BY MISSION SEGMENT MANUVR

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40			2						1				1				4
-30	9	3	14	3	7	20	16	19	16	16	13	9	5	6	1	2	159
-20	31	83	335	128	166	185	175	122	89	47	20	8	2	1	1		1393
-10	15	100	336	72	75	57	43	19	12	8	9	9	7	5			767
10	14	90	251	79	69	57	46	19	10	13	9	5	2	1	2		663
20	1	3	9	6	2	3		3		1							28
30							1										1
40																	
TOTAL	70	275	947	288	319	322	281	182	128	85	47	31	17	13	4	2	3015

CYCLIC PEAKS VS VELOCITY BY MISSION SEGMENT DESCNT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40																	
-30	49	4	1		1	3	4	2	4	4	1						73
-20	339	66	49	15	20	25	20	22	19	13	4						591
-10	91	20	24	4	5	2		1		1							148
10	54	3	2	3	2		1										65
20	1																1
30																	
40																	
TOTAL	533	93	76	22	28	30	25	25	23	18	5						878

TABLE XIV
CYCLIC STICK PEAKS VERSUS ROTOR RPM BY MISSION SEGMENT

CYCLIC PEAKS VS RPM BY MISSION SEGMENT ASCENT

	LESS	210	220	230	240	250	TOTAL
LESS							
-40							
-30			2		1		3
-20			40	115	1		156
-10			46	89			135
10		1	14	24			39
20							
30							
40							
TOTAL		1	102	228	2		333

CYCLIC PEAKS VS RPM BY MISSION SEGMENT MANUVR

	LESS	210	220	230	240	250	TOTAL
LESS							
-40			1	3			4
-30			39	119	1		159
-20			316	1069	8		1393
-10			285	480	2		767
10			331	332			663
20			13	15			28
30			1				1
40							
TOTAL			986	2018	11		3015

CYCLIC PEAKS VS RPM BY MISSION SEGMENT DESCNT

	LESS	210	220	230	240	250	TOTAL
LESS							
-40							
-30			37	35	1		73
-20			255	334	2		591
-10			62	84	2		148
10			35	30			65
20			1				1
30							
40							
TOTAL			390	483	5		878

TABLE XV
COLLECTIVE STICK PEAKS VERSUS COLLECTIVE STICK STEADY BY CYCLIC STICK STEADY

COLLECTIVE PEAKS VS COLL.STEADY BY CYCLIC STEADY 40

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					1						1
10											
20											
30											
40											
TOTAL					1						1
TIME	0.	0.	0.	0.4	450.3	1189.4	64.0	0.2	0.	0.	1704.3

COLLECTIVE PEAKS VS COLL.STEADY BY CYCLIC STEADY 50

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40						1					1
-30					1						1
-20											
-10					4	4					8
10						1					1
20											
30											
40											
TOTAL					5	6					11
TIME	0.	0.	0.5	1.7	240.5	692.2	68.1	0.	0.	0.	1002.9

TABLE XV - contd.

COLLECTIVE PEAKS VS COLL.STEADY BY CYCLIC STEADY 60

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20						1					1
-10						3					3
10											
20											
30											
40											
TOTAL						4					4
TIME	0.	0.	0.	0.1	6.9	49.7	11.5	0.	0.	0.	68.2

TABLE XVI
COLLECTIVE STICK PEAKS VERSUS COLLECTIVE STICK STEADY BY DENSITY ALTITUDE

COLLECTIVE PEAKS VS COLL. STEADY BY ALTITUDE LESS

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					2						2
10						1					1
20											
30											
40											
TOTAL					2	1					3
TIME	0.	0.	0.	0.4	19.4	4.6	C.	0.	0.	0.	24.4

COLLECTIVE PEAKS VS COLL. STEADY BY ALTITUDE 1000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					1						1
10											
20											
30											
40											
TOTAL					1						1
TIME	0.	0.	0.5	C.6	33.8	51.0	0.3	0.	C.	0.	86.2

COLLECTIVE PEAKS VS COLL. STEADY BY ALTITUDE 2000

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40						1					1
-30					1						1
-20						1					1
-10					2	7					9
10											
20											
30											
40											
TOTAL					3	9					12
TIME	0.	0.	0.	1.2	470.5	1143.2	98.4	1.1	C.	0.	1714.3

TABLE XVII
COLLECTIVE STICK PEAKS VERSUS COLLECTIVE STICK STEADY BY AIRSPEED

COLLECTIVE PEAKS VS COLL. STEADY BY VELOCITY LESS

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40						1					1
-30					1						1
-20						1					1
-10					5	6					11
10						1					1
20											
30											
40											
TOTAL					6	9					15
TIME	0.	0.	0.5	1.6	27.6	76.4	5.8	0.	0.	0.	111.9

COLLECTIVE PEAKS VS COLL. STEADY BY VELOCITY 110

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10						1					1
10											
20											
30											
40											
TOTAL						1					1
TIME	0.	0.	0.	0.	30.7	161.6	3.7	0.	0.	0.	196.1

TABLE XVIII
COLLECTIVE STICK PEAKS VERSUS COLLECTIVE STICK STEADY BY ROTOR RPM

COLLECTIVE PEAKS VS COLL. STEADY BY RPM 220

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40											
-30											
-20											
-10					4	4					8
10											
20											
30											
40											
TOTAL					4	4					8
TIME	0.	0.	0.3	0.8	207.1	759.3	54.2	0.	0.	0.	1021.9

COLLECTIVE PEAKS VS COLL. STEADY BY RPM 230

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40						1					1
-30					1						1
-20						1					1
-10					1	3					4
10						1					1
20											
30											
40											
TOTAL					2	6					8
TIME	0.	0.	0.2	1.4	502.2	1315.4	134.2	1.1	0.	0.	1954.6

COLLECTIVE PEAKS VS COLL. STEADY BY RPM TOTAL

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-40						1					1
-30					1						1
-20						1					1
-10					5	7					12
10						1					1
20											
30											
40											
TOTAL					6	10					16
TIME	0.	0.	0.5	2.2	709.8	2075.2	188.4	1.1	0.	0.	2977.2

TABLE XIX
COLLECTIVE STICK PEAKS VERSUS AIRSPEED ACCELERATION BY MISSION SEGMENT

COLLECTIVE PEAKS VS ACCELERATION BY MISS. SEG. ASCENT

	LESS	-15.0	-12.0	-9.0	-6.0	-3.0	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40						2						2
-30						1						1
-20					3	7						10
-10					1	150	16	3				170
10						152	14	3	1			170
20						4						4
30												
40												
TOTAL					4	316	30	6	1			357

COLLECTIVE PEAKS VS ACCELERATION BY MISS. SEG. MANUVR

	LESS	-15.0	-12.0	-9.0	-6.0	-3.0	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40						20	4	2				26
-30			2	1	31	143	45	20	3			245
-20			3	18	95	772	144	43	4			1079
-10			1	7	43	522	33	2	1			609
10				2	20	213	18	4				257
20						5	1					6
30												
40												
TOTAL			6	28	189	1675	245	71	8			2222

COLLECTIVE PEAKS VS ACCELERATION BY MISS. SEG. DESCNT

	LESS	-15.0	-12.0	-9.0	-6.0	-3.0	3.0	6.0	9.0	12.0	15.0	TOTAL
LESS												
-40				1	3	6						10
-30				6	53	226						285
-20				1	37	384	2					424
-10					3	95						98
10						36						36
20												
30												
40												
TOTAL				8	96	747	2					853

TABLE XX
COLLECTIVE STICK PEAKS VERSUS AIRSPEED BY MISSION SEGMENT

COLLECTIVE PEAKS VS VELOCITY BY MISSION SEGMENT ASCENT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40	2																2
-30			1														1
-20	3	1	2	1	3												10
-10	103	28	21	2	3	5	4	2	2								170
10	124	17	9	4	2	5	5	2	2								170
20	4																4
30																	
40																	
TOTAL	236	46	33	7	8	10	9	4	4								357

COLLECTIVE PEAKS VS VELOCITY BY MISSION SEGMENT MANUVR

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40	2	8	11	3	2	1	1										26
-30	12	38	132	15	19	9	5	2	2	3	3	1		4			245
-20	14	118	547	111	93	50	46	33	27	9	10	4	5	3	1		1079
-10	3	30	221	75	69	63	48	43	24	15	9	6	1	1	1		609
10	3	7	60	25	28	21	30	36	22	12	5	3	4	1			257
20		1			1			3	1								6
30																	
40																	
TOTAL	34	200	971	229	212	152	130	117	76	39	27	14	10	9	2		2222

TABLE XX - contd.

COLLECTIVE PEAKS VS VELOCITY BY MISSION SEGMENT DESCNT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-40	1	1	4		3	1											10
-30	23	85	126	18	16	6	5	4									285
-20	68	141	135	17	16	13	14	10	7	2		1					424
-10	71	8	4	[illegible]		3	4	5	1	3	1						98
10	32	2							1	1							36
20																	
30																	
40																	
TOTAL	195	241	269	35	35	21	23	17	9	6	1	1					853

TABLE XXI
COLLECTIVE STICK PEAKS VERSUS ROTOR RPM BY MISSION SEGMENT

COLLECTIVE PEAKS VS RPM BY MISSION SEGMENT ASCENT

	LESS	210	220	230	240	250	TOTAL
LESS							
-40			2				2
-30				1			1
-20			3	6	1		10
-10			73	97			170
10		1	95	74			170
20		1	2	1			4
30							
40							
TOTAL		2	175	179	1		357

COLLECTIVE PEAKS VS RPM BY MISSION SEGMENT MANUVR

	LESS	210	220	230	240	250	TOTAL
LESS							
-40				22	4		26
-30			21	219	5		245
-20			201	870	8		1079
-10			213	395	1		609
10			146	111			257
20			2	4			6
30							
40							
TOTAL			503	1621	18		2222

COLLECTIVE PEAKS VS RPM BY MISSION SEGMENT DESCNT

	LESS	210	220	230	240	250	TOTAL
LESS							
-40			1	8	1		10
-30			39	243	3		285
-20			96	324	4		424
-10			48	49	1		98
10			27	9			36
20							
30							
40							
TOTAL			211	633	9		853

TABLE XXII
GUST n_z VERSUS AIRSPEED BY MISSION SEGMENT BY ALTITUDE BY GROSS WEIGHT

NZ GUST PEAKS VS VEL. BY MISS. SEG. ASCENT, ALT. 2000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7			2						1								3
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			2						1								3

NZ GUST PEAKS VS VEL. BY MISS. SEG. ASCENT, ALT. 2000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2	1																1
0.8																	
0.7			1														1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1		1														2

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR, ALT. 2000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			1	1			1										3
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1	1			1										3

TABLE XXII - contd.

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR. ALT. 2000. WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1		1	1											3
1.2			1	1			1		[illegible]								5
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			2	1	1	1	1		2								8

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR. ALT. 2000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3							1										1
1.2			1	2		1	1		1								6
0.8																	
0.7			1	2	1												4
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			2	4	1	1	2		1								11

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR. ALT. 2000. WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			1														1
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1														1

TABLE XXII - contd.

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR. ALT. 5000. WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7																	
0.6							1										1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL							1										1

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR. ALT. 5000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2					1	1		1									3
0.8																	
0.7				1													1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL				1	1	1		1									4

NZ GUST PEAKS VS VEL. BY MISS. SEG. DESCNT. ALT. 2000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7							1										1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL							1										1

NZ GUST PEAKS VS VEL. BY MISS. SEG. DESCNT. ALT. 2000. WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7			1														1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1														1

TABLE XXIII
GUST n_z VERSUS μ BY MISSION SEGMENT BY ALTITUDE BY C_T/σ

NZ GUST PEAKS VS MU BY MISS. SEG. ASCENT. ALT. 2000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2			1							1
0.8										
0.7					3		1			4
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL			1		3		1			5

NZ GUST PEAKS VS MU BY MISS. SEG. MANUVR. ALT. 2000. CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2					2	3	1			6
0.8										
0.7										
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					2	3	1			6

NZ GUST PEAKS VS MU BY MISS. SEG. MANUVR. ALT. 2000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1	3				4
1.2					5	3	1			9
0.8										
0.7					3	1				4
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					9	7	1			17

NZ GUST PEAKS VS MU BY MISS. SEG. MANUVR. ALT. 5000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2						3				3
0.8										
0.7					1					1
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL					1	4				5

TABLE XXIII - contd.

NZ GUST PEAKS VS MU BY MISS. SEG. DESCNT, ALT. 2000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2										
0.8										
0.7					1	1				2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					1	1				2

TABLE XXIV
GUST n_z VERSUS μ BY MISSION SEGMENT

NZ GUST PEAKS VS MU BY MISS. SEG. ASCENT

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2			1							1
0.8										
0.7					3		1			4
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL			1		3		1			5

NZ GUST PEAKS VS MU BY MISS. SEG. MANUVR

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1	3				4
1.2					7	9	2			18
0.8										
0.7					4	1				5
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL					12	14	2			28

TABLE XXIV - contd.

NZ GUST PEAKS VS MU BY MISS. SEG. DESCNT

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2										
0.8										
0.7					1	1				2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					1	1				2

TABLE XXV
GUST n_z VERSUS AIRSPEED BY MISSION SEGMENT

NZ GUST PEAKS VS VEL. BY MISS. SEG. ASCENT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2	1																1
0.8																	
0.7			3						1								4
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1		3						1								5

NZ GUST PEAKS VS VEL. BY MISS. SEG. MANUVR

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1		1	1	1										4
1.2			4	4	1	2	3	1	3								18
0.8																	
0.7			1	3	1												5
0.6							1										1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			6	7	3	3	5	1	3								28

NZ GUST PEAKS VS VEL. BY MISS. SEG. DESCNT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7			1				1										2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1				1										2

TABLE XXVI
GUST n_z VERSUS μ

NZ GUST PEAKS VS MU COMPOSITE

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1	3				4
1.2			1		7	9	2			19
0.8										
0.7					8	2	1			11
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL			1		16	15	3			35

TABLE XXVII
GUST n_z VERSUS AIRSPEED

NZ GUST PEAKS VS VELOCITY COMPOSITE

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1		1	1	1										4
1.2	1		4	4	1	2	3	1	3								19
0.8																	
0.7			5	3	1		1		1								11
0.6							1										1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1		10	7	3	3	6	1	4								35

TABLE XXVIII
MANEUVER n_z VERSUS AIRSPEED BY MISSION SEGMENT BY ALTITUDE BY GROSS WEIGHT

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. LESS, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2						1											1
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1											1

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. LESS, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		1															1
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1															1

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 1000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			2														2
1.2																	
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			2														2

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 1000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			1														1
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1														1

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 1000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			3				1										4
0.8																	
0.7				1													1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			3	1			1										5

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 1000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		1		1		1											3
0.8																	
0.7		1	1														2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		2	1	1		1											5

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 2000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3				1													1
1.2																	
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL				1													1

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 2000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2	1		2	2													5
0.8																	
0.7			4	2		1	1										8
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1		6	4		1	1										13

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 2000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2	1	1	8	1			1		1								13
0.8																	
0.7			2		1	1	2										6
0.6					1												1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1	1	10	1	2	1	3		1								20

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 5000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1											1

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT, ALT. 5000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7					2				1								3
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL					2				1								3

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. LESS, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3								3									3
1.2		1	2		2		2	2	1	2			1				13
0.8																	
0.7						1			1								2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	2		2	1	2	5	2	2			1				18

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. LESS, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5			1														1
1.4						1											1
1.3			5		1		1	2	1	1							11
1.2			15	10	12	13	14	11	2	1	2	2					82
0.8																	
0.7			1						1								2
0.6						1											1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			22	10	13	15	15	13	4	2	2	2					98

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. LESS, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		1	12	6	9	6		3									37
0.8																	
0.7			2					1									3
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	14	6	9	6		4									40

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 1000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2								1		1							2
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1		1		1							3

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 1000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4									1			1					2
1.3			2	3		2	1	1	1	1		3	1	1			16
1.2		1	5	6	4	2	5	2	3	5		1	1	1			36
0.8																	
0.7						1			1			1					3
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	7	9	4	5	6	3	6	6		6	2	2			57

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR. ALT. 1000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4							1										1
1.3		1	3	1	2	3	2	2	1	2	1	2					20
1.2		2	8	6	5	4	5	3	4	3	1	1	3	3	1		49
0.8																	
0.7			1	2	2	3	2	2			1	2					15
0.6		1							1								2
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		4	12	9	9	10	10	7	6	5	3	5	3	3	1		87

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR. ALT. 1000. WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3				2													2
1.2		1		1	2												4
0.8																	
0.7																	
0.6				1													1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1		4	2												7

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR. ALT. 2000. WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5			1		2	1											4
1.4			1	1	1	3	1		1		3	1					12
1.3		1	10		1	2	3		2	2	1	1					23
1.2		9	31	17	8	5	9		3	2	2	1	1	1			89
0.8																	
0.7		1	12	5	6	3	2										29
0.6	1		2														3
0.5			1														1
0.4																	
0.2																	
LESS																	
TOTAL	1	11	58	23	18	14	15		6	4	6	3	1	1			161

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR. ALT. 2000. WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8							1										1
1.7			1				1										2
1.6				1	1			1	1	1							5
1.5			2	1	1		1		3		3	4	2		1		18
1.4		2	8	5	5	3	6	4	9	3		7	2	3	2		59
1.3	1		41	8	21	18	13	14	13	11	13	13	4	5			175
1.2	3	31	201	67	71	65	46	35	28	23	17	11	6	3	1	1	611
0.8																	
0.7	3	12	68	15	17	17	7	6	6	5	1	1					158
0.6		3	14	3	1	1		2			1						25
0.5			1		1				1					1			4
0.4																	
0.2																	
LESS																	
TOTAL	7	48	338	100	118	104	75	62	61	43	35	36	14	12	4	1	1058

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 2000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7								1								1	2
1.6					2					2	1						5
1.5				1	2		1		4	1		1	4	2			15
1.4		1	9	4	4	8	4	9	8	8	8	6	3	3	2		77
1.3		7	61	26	17	26	31	18	15	15	20	9	7	5	2		259
1.2	2	45	282	105	91	109	79	73	40	48	13	16	2	6	3	2	916
0.8																	
0.7	2	23	101	25	30	25	17	10	6	4	4	2	3				252
0.6			21	2	3	4		1	1								32
0.5			1	1	2												4
0.4																	
0.2																	
LESS																	
TOTAL	4	76	475	164	151	172	132	112	74	78	46	34	18	16	7	3	1562

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 2000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4								1									1
1.3				1				1									2
1.2			4	5	7	1	3	1	1	1							23
0.8																	
0.7		1	3	1		3		2									10
0.6							1										1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	7	7	7	4	4	5	1	1							37

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 5000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5						1											1
1.4			1				1										2
1.3			1		2												3
1.2			7	6	4	2	5	3	2	2							31
0.8																	
0.7				1	1	2											4
0.6		1				1											2
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	9	7	7	6	6	3	2	2							43

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 5000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5					3	1					1			1			6
1.4			1			1		1		1	2						6
1.3			7			4	2	2	3	1	1						20
1.2		3	18	11	10	11	11	12	10	1	2						89
0.6																	
0.7		2	16	3	3	1	3	1	2								31
0.6	1		2														3
0.5			1														1
0.4																	
0.2																	
LESS																	
TOTAL	1	5	45	14	16	18	16	16	15	3	6			1			156

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 5000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4			1				2		1		2	1		1			9
1.3			7	1	1	3		2		1		1	1				17
1.2		4	29	16	22	14	10	10	3	4		2	2	1		1	119
0.8																	
0.7		6	17	4	6	3	5	2	1							1	45
0.6				2				1									3
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		10	54	23	29	20	17	15	5	5	2	4	3	2		2	191

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR, ALT. 5000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1											1

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. LESS, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1														1
1.2																	
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1														1

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. 1000, WGT. 25000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7									1								1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL									1								1

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 1000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			1		1												2
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1		1	1											3

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 1000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		2	3	1													6
0.8																	
0.7					1												1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		2	3	1	1												7

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 1000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1														1
1.2			2	1													3
0.8																	
0.7																	
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			3	1													4

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 2000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		1	3		2	1	1										8
0.8																	
0.7		1	1	1	2	1	1										7
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		2	4	1	4	2	2										15

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. 2000, WGT. 24000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2		2		1		1	2	1	1								8
0.8																	
0.7						1	1	1	1	2							6
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		2		1		2	3	2	2	2							14

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. 2000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4			1														1
1.3				1	1												2
1.2		1	9	6	5	4	2		2								29
0.8																	
0.7				1		2	2										5
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL		1	10	8	6	6	4		2								37

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. 2000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			1														1
1.2	1	1	3														5
0.8																	
0.7		2	2														4
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1	3	6														10

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT, ALT. 5000, WGT. 24000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7										1							1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL										1							1

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 5000. WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7								1	1	1							3
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL								1	1	1							3

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT. ALT. 5000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2								1									1
0.8																	
0.7							1			1							2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL							1	1		1							3

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY. ALT. LESS. WGT. 30000

	LESS	40	6	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2					1			1									2
0.8																	
0.7																	
0.6					1												1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL					2			1									3
TIM	4.2	2.8	4.2	0.6	0.5	1.4	0.9	1.4	1.0	0.	0.	0.	0.	0.	0.	0.	17.1

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY. ALT. 1000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2										1	1						2
0.8																	
0.7							1										1
0.6												1					1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL							1			1	1	1					4
TIM	2.2	0.9	5.7	4.8	3.0	3.6	6.1	9.1	7.9	5.7	3.5	7.0	0.6	0.2	0.	0.	60.4

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY, ALT. 2000, WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7					1												1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL					1												1
TIME	1.4	0.	0.	0.4	2.1	6.9	8.2	10.0	14.8	6.7	0.6	0.	0.	0.	0.	0.	51.1

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY, ALT. 2000, WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2					6	1		1									8
0.8																	
0.7								1		1							2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL					6	1		2		1							10
TIME	6.3	0.8	10.9	14.4	20.5	24.8	42.6	43.4	35.3	21.2	3.8	0.8	0.	0.	0.	0.	224.7

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY, ALT. 2000, WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			2	1	1	1	1	2	3	1	1						13
0.8																	
0.7						2			2	5	2						11
0.6											1						1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			2	1	1	3	1	2	5	6	4						25
TIME	52.0	3.3	83.3	61.7	90.5	104.6	159.8	275.2	189.7	78.0	19.9	2.0	0.	0.	0.	0.	1069.5

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY, ALT. 2000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2						1		1	1	1							4
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						2		1	1	1							5
TIME	35.9	1.6	41.5	24.0	33.7	37.7	48.5	78.6	48.[illegible]	17.8	1.5	0.	0.	0.	0.	0.	369.0

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY. ALT. 5000. WGT. 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7								1									1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL								1									1
TIME	0.	0.	1.4	1.6	3.1	3.7	7.5	7.1	15.5	11.5	0.4	0.	0.	0.	0.	0.	51.7

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY. ALT. 5000. WGT. 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2						1											1
0.8																	
0.7							2										2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1	2										3
TIME	0.	0.	2.5	6.4	11.1	22.0	30.4	32.0	32.0	10.7	3.5	0.1	0.	0.	0.	0.	150.7

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY. ALT. 5000. WGT. 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			1		1	3		1									6
0.8																	
0.7						1				1							2
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			1		1	4		1		1							8
TIME	0.	0.5	74.3	59.7	91.9	122.2	132.1	146.0	117.7	34.8	3.8	0.6	0.	0.	0.	0.	783.8

TABLE XXVIII - contd.

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY, ALT. 5000, WGT. 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2																	
0.8																	
0.7						1											1
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL						1											1
TIME	0.	0.	14.5	13.2	23.0	24.5	25.4	27.6	30.3	5.8	1.8	0.	0.	0.	0.	0.	166.2

TABLE XXIX
MANEUVER n_z VERSUS μ BY MISSION SEGMENT BY ALTITUDE BY C_T/σ

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT, ALT. LESS, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2				1		1				2
0.8										
0.7										
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				1		1				2

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT, ALT. 1000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					2					2
1.2										
0.8										
0.7										
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					2					2

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT, ALT. 1000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2				1	5	2				8
0.8										
0.7			1		2					3
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL			1	1	7	2				11

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT, ALT. 2000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1					1
1.2			2	1	13	1	1			18
0.8										
0.7				1	7	6				14
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL			2	2	21	8	1			34

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT, ALT. 5000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2										
0.8										
0.7						3	1			4
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL						3	1			4

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. LESS, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5					1					1
1.4						1				1
1.3					5	7	2			14
1.2				2	33	69	9			113
0.8										
0.7					2	1	2			5
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL				2	41	79	13			135

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. LESS, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2				1	10	8				19
0.8										
0.7					1	1				2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				1	11	9				21

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 1000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4						1				1
1.3				1	1	3	3			8
1.2				1	6	9	8	2		26
0.8										
0.7						2				2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				2	7	15	11	2		37

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 1000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4						1	1			2
1.3				2	7	10	10	1		30
1.2				4	18	27	11	5		65
0.8										
0.7					4	8	5			17
0.6				1	1	1				3
0.5										
0.4										
0.2										
LESS										
TOTAL				7	30	47	27	6		117

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 2000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6						1				1
1.5					1	3	1			5
1.4					6	12	6	1		25
1.3			1	3	24	11	18	2		59
1.2				17	69	47	17	3		153
0.8										
0.7				4	15	15	2			36
0.6				4						4
0.5					2			1		3
0.4										
0.2										
LESS										
TOTAL			1	28	117	89	44	7		286

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 2000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8						1				1
1.7					1	2		1		4
1.6					1	4	4			9
1.5					4	6	17	5		32
1.4				4	22	42	44	12		124
1.3				19	105	161	98	17		400
1.2		1	8	110	587	585	177	18		1486
0.8										
0.7			8	57	189	132	26	1		413
0.6			2	8	33	12	2			57
0.5					4	1	1			6
0.4										
0.2										
LESS										
TOTAL		1	18	198	946	946	369	54		2532

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 5000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5						1				1
1.4					1					1
1.3							1			1
1.2					1					1
0.8										
0.7				1	1					2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				1	3	1	1			6

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR, ALT. 5000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5						4	1	1		6
1.4					2	6	7			15
1.3					17	15	7			39
1.2				12	82	120	20	2	1	237
0.8										
0.7				10	36	29	3	1		79
0.6			2		4	2				8
0.5					1					1
0.4										
0.2										
LESS										
TOTAL			2	22	142	176	38	4	1	385

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT, ALT. LESS, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1					1
1.2										
0.8										
0.7										
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					1					1

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT, ALT. 1000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2					2					2
0.8										
0.7						1	1			2
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					2	1	1			4

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT, ALT. 1000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					1					1
1.2				2	6	1				9
0.8										
0.7						1				1
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				2	7	2				11

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT, ALT. 2000, CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2				1	5	1				7
0.8										
0.7				1	2	3				6
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL				2	7	4				13

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT, ALT. 2000, CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4					1					1
1.3					2	1				3
1.2		1		4	18	17	3			43
0.8										
0.7				3	2	8	3			16
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL		1		7	23	26	6			63

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT. ALT. 5000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2						1				1
0.8										
0.7						2	4			6
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL						3	4			7

NZ MANEUVERS VS MU BY MISS. SEG. STEADY. ALT. LESS. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2						2				2
0.8										
0.7										
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL						3				3
TIME	0.1	2.2	1.4	2.2	1.5	3.3	0.1	0.	0.	10.9

NZ MANEUVERS VS MU BY MISS. SEG. STEADY. ALT. 1000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2							2			2
0.8										
0.7						1				1
0.6							1			1
0.5										
0.4										
0.2										
LESS										
TOTAL						1	3			4
TIME	0.	3.1	1.4	0.2	11.4	23.7	35.2	0.2	0.	75.1

NZ MANEUVERS VS MU BY MISS. SEG. STEADY. ALT. 2000. CT/S 0.12

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2										
0.8										
0.7						1				1
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL						1				1
TIME	0.	1.6	0.	0.	3.4	18.4	3.5	0.	0.	26.8

TABLE XXIX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. STEADY. ALT. 2000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2					6	12	7			25
0.8										
0.7						4	10			14
0.6							1			1
0.5										
0.4										
0.2										
LESS										
TOTAL					6	16	18			40
TIME	22.7	62.1	9.2	8.7	224.6	979.7	360.3	0.	0.	1667.5

NZ MANEUVERS VS MU BY MISS. SEG. STEADY. ALT. 5000. CT/S 0.15

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2					1	6				7
0.8										
0.7						5	1			6
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL					1	11	1			13
TIME	0.	0.	0.	1.8	172.9	742.7	230.8	0.	0.	1148.3

TABLE XXX
MANEUVER n_z VERSUS μ BY MISSION SEGMENT

NZ MANEUVERS VS MU BY MISS. SEG. ASCENT

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3					3					3
1.2			2	3	10	4	1			20
0.8										
0.7			1	1	9	9	1			21
0.6						1				1
0.5										
0.4										
0.2										
LESS										
TOTAL			3	4	30	14	2			53

TABLE XXX - contd.

NZ MANEUVERS VS MU BY MISS. SEG. MANUVR

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8						1				1
1.7					1	2		1		4
1.6					1	5	4			10
1.5					6	14	19	6		45
1.4				4	31	63	58	13		169
1.3			1	25	159	207	139	20		551
1.2		1	6	147	806	865	242	30	1	2100
0.8										
0.7			8	72	248	188	38	2		556
0.6			4	13	39	16	2			73
0.5					7	1	1	1		10
0.4										
0.2										
LESS										
TOTAL		1	21	261	1297	1362	503	73	1	3519

NZ MANEUVERS VS MU BY MISS. SEG. DESCNT

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4					1					1
1.3					4	1				5
1.2		1		7	31	20	3			62
0.8										
0.7				4	4	15	8			31
0.6										
0.5										
0.4										
0.2										
LESS										
TOTAL		1		11	40	36	11			99

NZ MANEUVERS VS MU BY MISS. SEG. STEADY

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8										
1.7										
1.6										
1.5										
1.4										
1.3										
1.2					7	20	9			36
0.8										
0.7						11	11			22
0.6						1	2			3
0.5										
0.4										
0.2										
LESS										
TOTAL					7	[illegible]2	22			61
TIME	27.1	72.9	12.7	13.6	419.1	1778.7	653.1	0.2	0.	2977.2

TABLE XXXI
MANEUVER n_z VERSUS AIRSPEED BY MISSION SEGMENT

NZ MANEUVERS VS VEL. BY MISS. SEG. ASCENT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3			2	1													3
1.2		3	14	4		2	2		1								29
0.8																	
0.7		1	7	3	3	3	3		1								21
0.6					1												1
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	2	4	23	8	4	5	5		2								53

NZ MANEUVERS VS VEL. BY MISS. SEG. MANUVR

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8							1										1
1.7			1				1	1								1	4
1.6				1	3			1	1	3	1						10
1.5			4	2	8	3	2		7	1	4	5	5	3	1		45
1.4		3	21	10	10	16	15	15	20	12	15	16	5	7	4		169
1.3	1	9	137	42	45	58	53	45	36	34	36	29	13	11	2		551
1.2	5	98	616	256	247	232	189	156	97	93	37	34	16	15	5	4	2100
0.8																	
0.7	5	45	221	56	65	61	36	24	18	9	6	6	3			1	556
0.6	2	5	39	8	4	7	1	4	2		1						73
0.5			4	1	3				1					1			10
0.4																	
0.2																	
LESS																	
TOTAL	13	160	1043	376	385	377	298	246	187	152	100	90	42	37	12	6	3519

NZ MANEUVERS VS VEL. BY MISS. SEG. DESCNT

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4			1														1
1.3			3	1	1												5
1.2	1	7	21	9	8	6	5	2	3								62
0.8																	
0.7		3	3	2	3	5	5	2	3	5							31
0.6																	
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL	1	10	28	12	12	11	10	4	6	5							99

NZ MANEUVERS VS VEL. BY MISS. SEG. STEADY

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8																	
1.7																	
1.6																	
1.5																	
1.4																	
1.3																	
1.2			3	1	9	7	1	6	4	3	2						36
0.8																	
0.7					1	5	3	2	2	7	2						22
0.6					1						1	1					3
0.5																	
0.4																	
0.2																	
LESS																	
TOTAL			3	1	11	12	4	8	6	10	5	1					61
TIME	111.9	10.0	238.9	187.7	280.2	351.9	463.5	584.3	496.5	196.1	41.2	13.3	1.4	0.2	0.	0.	2977.2

TABLE XXXII
MANEUVER n_z VERSUS μ

NZ MANEUVERS VS MU COMPOSITE

	LESS	0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	TOTAL
2.4										
2.2										
2.0										
1.8						1				1
1.7					1	2		1		4
1.6					1	5	4			10
1.5					6	14	19	6		45
1.4				4	32	63	58	13		170
1.3			1	25	166	208	139	20		559
1.2		2	10	157	862	909	255	30	1	2226
0.8										
0.7			9	77	261	223	58	2		630
0.6			4	13	38	18	4			77
0.5					7	1	1	1		10
0.4										
0.2										
LESS										
TOTAL		2	24	276	1374	1444	538	73	1	3732

TABLE XXXIII
MANEUVER n_z VERSUS AIRSPEED

NZ MANEUVERS VS VELOCITY COMPOSITE

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
2.4																	
2.2																	
2.0																	
1.8							1										1
1.7			1				1	1								1	4
1.6				1	3			1	1	3	1						10
1.5			4	2	8	3	2		7	1	4	5	5	3	1		45
1.4		3	22	10	10	16	15	15	20	12	[illegible]	16	5	7	4		170
1.3	1	9	142	44	46	58	53	45	36	34	36	29	13	11	2		559
1.2	8	108	654	270	264	247	197	164	105	96	39	34	16	15	5	4	2226
0.8																	
0.7	5	49	231	61	72	74	47	28	24	21	8	6	3			1	630
0.6	2	5	39	8	6	7	1	4	2		2	1					77
0.5			4	1	3				1					1			10
0.4																	
0.2																	
LESS																	
TOTAL	16	174	1097	397	412	405	317	258	196	167	105	91	42	37	12	6	3732

TABLE XXXIV
PEAK n_x VERSUS AIRSPEED BY GROSS WEIGHT

NX PEAKS FOR NX VS VELOCITY BY WEIGHT 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15																	
-0.10																	
0.10	32									1	1	1					35
0.15	2																2
0.20	1																1
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	35									1	1	1					38

NX PEAKS FOR NX VS VELOCITY BY WEIGHT 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15											1	1	2		1		5
-0.10																	
0.10	93	2	3		1				1								100
0.15	6																6
0.20	1																1
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	100	2	3		1				1		1	1	2		1		112

NX PEAKS FOR NX VS VELOCITY BY WEIGHT 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15			1		1					1	1	1	2	1	1	1	10
-0.10																	
0.10	355	1	2								1						359
0.15	38																38
0.20	7																7
0.25	1																1
0.30																	
0.35																	
0.40																	
TOTAL	401	1	3		1					1	2	1	2	1	1	1	415

NX PEAKS FOR NX VS VELOCITY BY WEIGHT 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15																	
-0.10																	
0.10	298	1															299
0.15	36																36
0.20	2																2
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	336	1															337

TABLE XXXV
PEAK n_x VERSUS AIRSPEED BY ALTITUDE

NX PEAKS FOR NX VS VELOCITY BY ALTITUDE LESS

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15																	
-0.10																	
0.10	55		1														56
0.15	1																1
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	56		1														57

NX PEAKS FOR NX VS VELOCITY BY ALTITUDE 1000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15												1					1
-0.10																	
0.10	187																187
0.15	12																12
0.20	1																1
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	200											1					201

NX PEAKS FOR NX VS VELOCITY BY ALTITUDE 2000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15			1		1					1	2	1	3	1	2		12
-0.10																	
0.10	533	4	4		1				1	1	2	1					547
0.15	69																69
0.20	10																10
0.25	1																1
0.30																	
0.35																	
0.40																	
TOTAL	613	4	5		2				1	2	4	2	3	1	2		619

NX PEAKS FOR NX VS VELOCITY BY ALTITUDE 5000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15													1			1	2
-0.10																	
0.10	3																3
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	3												1			1	5

TABLE XXXV - contd.

NX PEAKS FOR NX VS VELOCITY BY ALTITUDE TOTAL

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15			1		1					1	2	2	4	1	2	1	15
-0.10																	
0.10	778	4	5		1				1	1	2	1					793
0.15	82																82
0.20	11																11
0.25	1																1
0.30																	
0.35																	
0.40																	
TOTAL	872	4	6		2				1	2	4	3	4	1	2	1	902

TABLE XXXVI
PEAK n_x VERSUS CYCLIC STICK POSITION BY MISSION SEGMENT

NX PEAKS FOR NX VS CYCLIC STEADY BY MISS. SEG. ASCENT

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15											
-0.10											
0.10	1			6	404	5					416
0.15				2	32	1	1				36
0.20					5						5
0.25											
0.30											
0.35											
0.40											
TOTAL	1			8	441	6	1				457

NX PEAKS FOR NX VS CYCLIC STEADY BY MISS. SEG. MANUVR

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15		1	1	9	4						15
-0.10											
0.10				2	13	3					18
0.15					1						1
0.20											
0.25											
0.30											
0.35											
0.40											
TOTAL		1	1	11	18	3					34

TABLE XXXVI - contd.

NX PEAKS FOR NX VS CYCLIC STEADY BY MISS. SEG. DESCNT

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15											
-0.10											
0.10				5	288	6					299
0.15					33						33
0.20					6						6
0.25					1						1
0.30											
0.35											
0.40											
TOTAL				5	328	6					339

NX PEAKS FOR NX VS CYCLIC STEADY BY MISS. SEG. STEADY

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15											
-0.10											
0.10				2	56	2					60
0.15					12						12
0.20											
0.25											
0.30											
0.35											
0.40											
TOTAL				2	68	2					72
TIME	0.	0.	0.	199.3	1704.3	1002.9	68.2	2.5	0.	0.	2977.2

NX PEAKS FOR NX VS CYCLIC STEADY BY MISS. SEG. TOTAL

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15		1	1	9	4						15
-0.10											
0.10	1			15	761	16					793
0.15				2	78	1	1				82
0.20					11						11
0.25					1						1
0.30											
0.35											
0.40											
TOTAL	1	1	1	26	855	17	1				902

TABLE XXXVII
PEAK n_x VERSUS n_z

NX PEAKS FOR NZ VS NX

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
2.4																
2.2																
2.0																
1.8																
1.7																
1.6																
1.5							1		1							2
1.4									3							3
1.3							1		4							5
1.2									5	1						6
0.8							13		780	81	11	1				886
0.7																
0.6																
0.5																
0.4																
0.2																
LESS																
TOTAL							15		793	82	11	1				902

TABLE XXXVIII
PEAK n_x VERSUS n_y

NX PEAKS FOR NX VS NY

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
LESS																
-0.40																
-0.35																
-0.30																
-0.25																
-0.20																
-0.15								15								15
-0.10																
0.10							2	791								793
0.15								82								82
0.20								11								11
0.25								1								1
0.30																
0.35																
0.40																
TOTAL							2	900								902

TABLE XXXIX
PEAK n_y VERSUS AIRSPEED BY GROSS WEIGHT

NY PEAKS FOR NY VS VELOCITY BY WEIGHT 26000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15	2		1		1	2	1										7
-0.10																	
0.10	2				1												3
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	4		1		2	2	1										10

TABLE XXXIX - contd.

NY PEAKS FOR NY VS VELOCITY BY WEIGHT 28000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20												1					1
-0.15	2		6	2	1	3	8	1	3		2		1				29
-0.10																	
0.10	2		3		2		1	1	1		1						11
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	4		9	2	3	3	9	2	4		3	1	1				41

NY PEAKS FOR NY VS VELOCITY BY WEIGHT 30000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20	1																1
-0.15	12		9	4	4	1	2	2	2				1		1		38
-0.10																	
0.10	18		9	5	3	3			1	1							40
0.15										1							1
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	31		18	9	7	4	2	2	3	2			1		1		80

NY PEAKS FOR NY VS VELOCITY BY WEIGHT 32000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25	1																1
-0.20	1																1
-0.15	4		1	1													6
-0.10																	
0.10	12		1														13
0.15																	
0.20																	
0.25																	
0.30	1																1
0.35																	
0.40																	
TOTAL	19		2	1													22

TABLE XL
PEAK n_y VERSUS AIRSPEED BY ALTITUDE

NY PEAKS FOR NY VS VELOCITY BY ALTITUDE LESS

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15	1		1						1								3
-0.10																	
0.10																	
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	1		1						1								3

TABLE XL - contd.

NY PEAKS FOR NY VS VELOCITY BY ALTITUDE 1000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15	3			1											1		5
-0.10																	
0.10	4		1														5
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
0.40																	
TOTAL	7		1	1											1		10

NY PEAKS FOR NY VS VELOCITY BY ALTITUDE 2000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25	1																1
-0.20	2											1					3
-0.15	16		16	5	5	6	11	3	3		2		1				69
-0.10																	
0.10	30		11	5	5	3	1	1	2	1	1						60
0.15										1							1
0.20																	
0.25																	
0.30	1																1
0.35																	
0.40																	
TOTAL	50		27	10	11	9	12	4	5	2	3	1	1				135

NY PEAKS FOR NY VS VELOCITY BY ALTITUDE 5000

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25																	
-0.20																	
-0.15				1					1				1				3
-0.10																	
0.10			1		1												2
0.15																	
0.20																	
0.25																	
0.30																	
0.35																	
.40																	
TOTAL			1	1	1				1				1				5

NY PEAKS FOR NY VS VELOCITY BY ALTITUDE TOTAL

	LESS	40	60	80	85	90	95	100	105	110	115	120	125	130	135	140	TOTAL
LESS																	
-0.40																	
-0.35																	
-0.30																	
-0.25	1																1
-0.20	2											1					3
-0.15	20		17	7	6	6	11	3	5		2		2		1		80
-0.10																	
0.10	14		13	5	6	3	1	1	2	1	1						67
0.15										1							1
0.20																	
0.25																	
0.30	1																1
0.35																	
0.40																	
TOTAL	58		30	12	12	9	12	4	7	2	3	1	2		1		153

TABLE XLI
PEAK n_y VERSUS CYCLIC STICK POSITION BY MISSION SEGMENT

NY PEAKS FOR NY VS CYCLIC STEADY BY MISS. SEG. ASCENT

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15					5	1					6
-0.10											
0.10				1	15	1	1				18
0.15											
0.20											
0.25											
0.30											
0.35											
0.40											
TOTAL				1	20	2	1				24

NY PEAKS FOR NY VS CYCLIC STEADY BY MISS. SEG. MANUVR

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20					1						1
-0.15				6	53	1					60
-0.10											
0.10				4	21	5	1				31
0.15					1						1
0.20											
0.25											
0.30											
0.35											
0.40											
TOTAL				10	76	6	1				93

NY PEAKS FOR NY VS CYCLIC STEADY BY MISS. SEG. DESCNT

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25					1						1
-0.20					2						2
-0.15				1	8	1					10
-0.10											
0.10					14						14
0.15											
0.20											
0.25											
0.30					1						1
0.35											
0.40											
TOTAL				1	26	1					28

NY PEAKS FOR NY VS CYCLIC STEADY BY MISS. SEG. STEADY

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25											
-0.20											
-0.15					4						4
-0.10											
0.10					4						4
0.15											
0.20											
0.25											
0.30											
0.35											
0.40											
TOTAL					8						8
TIME	0.	0.	0.	199.3	1704.3	1002.9	68.2	2.5	0.	0.	2977.2

TABLE XLI - contd.

NY PEAKS FOR NY VS CYCLIC STEADY NY DIFF. SEG. TOTAL

	LESS	10	20	30	40	50	60	70	80	90	TOTAL
LESS											
-0.40											
-0.35											
-0.30											
-0.25					1						1
-0.20					1						1
-0.15				7	70	3					80
-0.10											
0.10				5	54	6	2				67
0.15					1						1
0.20											
0.25											
0.30					1						1
0.35											
0.40											
TOTAL				12	130	9	2				153

TABLE XLII
PEAK n_y VERSUS n_z

NY PEAKS FOR NZ VS NY

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
2.4																
2.2																
2.0																
1.8																
1.7																
1.6																
1.5																
1.4							4		1							5
1.3							7		3							10
1.2							14		2							16
0.8					1	3	55		60	1			1			121
0.7									1							1
0.6																
0.5																
0.4																
0.2																
LESS																
TOTAL					1	3	80		67	1			1			153

TABLE XLIII
PEAK n_y VERSUS n_x

NY PEAKS FOR NY VS NX

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
LESS																
-0.40																
-0.35																
-0.30																
-0.25									1							1
-0.20								1	1	1						3
-0.15								70	9	1						80
-0.10																
0.10								37	20	7	2	1				67
0.15								1								1
0.20																
0.25																
0.30									1							1
0.35																
0.40																
TOTAL								109	32	9	2	1				153

TABLE XLIV
PEAK n_z VERSUS n_x

NZ MANEUVER PEAKS FOR NZ VS NX

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
2.4																
2.2																
2.0																
1.8								1								1
1.7								4								4
1.6								10								10
1.5								44	1							45
1.4								167	1							170
1.3							1	558								559
1.2							1	2221	2	2						2226
0.8																
0.7							4	626								630
0.6								77								77
0.5								10								10
0.4																
0.2																
LESS																
TOTAL							6	3718	6	2						3732

TABLE XLV
PEAK n_z VERSUS n_y

NZ MANEUVER PEAKS FOR NZ VS NY

	LESS	-0.40	-0.35	-0.30	-0.25	-0.20	-0.15	-0.10	0.10	0.15	0.20	0.25	0.30	0.35	0.40	TOTAL
2.4																
2.2																
2.0																
1.8								1								1
1.7								4								4
1.6								10								10
1.5								45								45
1.4							2	168								170
1.3							3	555	1							559
1.2							5	2214	5	2						2226
0.8																
0.7								627	3							630
0.6								77								77
0.5								10								10
0.4																
0.2																
LESS																
TOTAL							10	3711	9	2						3732

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11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY
	US Army Aviation Materiel Laboratories Fort Eustis, Virginia

13 ABSTRACT From a structural flight loads program on three armed and armored CH-47A helicopters, 207 hours of valid multichannel flight data were recorded as the helicopters operated from air bases in Southeast Asia. Data were processed and analyzed according to four distinct flight phases, termed mission segments: (1) takeoff and ascent; (2) maneuver; (3) descent, flare, and landing; and (4) steady state. Data are presented in the form of time and occurrence tables, histograms, and exceedance curves. These data indicate the time spent in the mission segments and parameter ranges; the number of peak parameter values occurring in the ranges of the given parameter, during each of the mission segments, and in the ranges of one or more related parameters; and the time to reach or exceed given maneuver and gust normal load factors and lateral and longitudinal load factors. The largest normal load factor was 1.95, which occurred at a 100-knot airspeed and with a 28,027-pound gross weight. In contrast to previous studies of cargo and transport CH-47A's whose activity was mostly under steady-state conditions, the armed CH-47A's spent more than half of their time in the maneuver mission segment and had a much more pronounced loads spectrum.

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14 KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
CH-47A helicopter operations aircraft structures operational airloads combat operations multichannel data						

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